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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. JANUARY 11, 1900. CHICAGO, ILL. NUMBER 2

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Iron Trade Review
Cleveland, Ohio.

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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. JANUARY 11, 1900. CHICAGO, ILL. NUMBER 2

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The first ten days of the new year have been quiet in all iron markets, but they have developed unmistakable signs of strength. That the holidays and the quiet weeks preceding have passed without any weakening in the pig iron market, and that prices of finished materials have gone practically unchanged for a month, is regarded as decisive answer for some time at least to the universal question concerning the probability of lower prices. In the South the holiday week was practically lost to many furnaces, prosperous labor requiring more than the usual time for festivity. With some Pennsylvania and Central Western furnaces the failure to get sufficient coke has shortened output, and the shortage of cars for coke transport is still such that railroads practically decide who shall have coke and who shall go without. In this feature the situation promises no immediate improvement. With the large furnace capacity active Dec. 1 there was prospect of some slight gain in stocks in December, but the shortened production in the last week of the year probably prevented this. Foundry operations were never on such a scale as to-day's, and this promises to increase in the next few months. Yet those who have not bought for all their needs in the first half of the year—some prominent consumers among the number—are still holding off. Whether the termination of the present quiet interval comes in one week or four weeks, conditions are such that no great buying movement would be required to tighten the whole list, including even the less known and less desirable irons on which some inducements have been offered to secure forward orders. The largest producer of cast iron pipe has not entered the market as yet. Heretofore the January purchases of the constituent companies have been a large factor. The influence of strong interests upon the market, both from without and from within, has been apparent recently. The merging of railway interests, which is a definite development of the new year, will tend to maintain freight rates, add to railway earnings and prolong the present price basis in important industries. Its effect on the iron trade is unquestionable. More directly bearing on prices of iron and steel is the evident attitude of the strong producers who in large part can determine the course of prices in Bessemer steel and in some finished lines. Though any formal agreement on billets is denied, sales have been made at $35 Central Western mill, and that price is uniformly quoted. It is known that considerable business has been booked on this basis for the first half of the year. A development of the week in bar iron was in connection with the meeting at Chicago of members of the National Hardware Association. The fact that stocks in second hands have moved slowly of late has led to some question as to the permanence of the present price basis. It was disclosed at the Chicago meeting that the leading producer of bar iron is filled for months and that jobbers who might sell their stocks now would simply pay to-day's price to replace them and would wait until summer on some sizes to get their orders filled. The result has been a much firmer feeling in this department and an end to any talk of lower prices. The new efforts toward a sheet mill consolidation have had some effect on that market, most makers putting a 60-day limit on deliveries, while some ask higher prices. Reports from England indicate that a famine in the North of England coal trade is imminent and this is already affecting iron producers to an extent. Some blast furnaces are banked.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
705 PUBLICATION BUILDING, JAN. 10.

The week under review has been decidedly quiet, but prices are well maintained and there has developed no indication that lower prices will prevail, at least in the near future. It is now generally accepted that there will be very little buying ahead this year. Orders will be placed from time to time, as the consumption warrants, and for this reason the market promises to be steady. Under ordinary conditions mills would be uneasy, but as matters stand it is felt that such a course will be best for all. Prices in general show no change from last week. Prices on Bessemer steel are very firm, and there does not seem to be any possibility of shading $35.

The outlook in most lines is very good for a large demand through the summer. This is particularly the case with structural material. In other lines there is a steady consumption and a fair amount of buying.

PIG IRON.—The pig iron market has been very quiet, but prices are maintained very firm. There are no large lots of Bessemer to be had for the first half, and for the third quarter buyers are showing no interest whatever. For pretty prompt delivery odd lots of a thousand or two thousand tons have been sold at $25, Pittsburg, and very small lots have sold as high as $25.25. For later delivery, $24, valley, is the minimum quotation. In foundry and forge irons there has been a fair amount of selling, but prices remain unchanged.

Bessemer, valley furnace	$24.00 to $24.35
Bessemer, Pittsburg	24.90 to 25.25
No. 1 Foundry	23.75 to 24.00
No. 2 Foundry	23.00 to 23.25
No. 3 Foundry	22.25 to 22.50
Gray Forge, valley furnace	21.00 to 21.25
Gray Forge, Pittsburg	21.00 to 21.50

STEEL.—There has been very little done in steel. Bessemer is very firm at $35 for billets and $36 for sheet bars. There has not been a great deal done, and mills are not expecting consumers to contract any distance ahead. In basic open-hearth steel prices are not as strong as they were some time ago, but they are still above the Bessemer by a much greater spread than formerly prevailed. We quote basic open-hearth steel billets at $43 to $45, makers' mill, Pittsburg.

FERRO-MANGANESE.—The market remains about the same as last reported in ferro-manganese, and the only producer in this market continues to quote $125 for 80 per cent.

RAILS AND TRACK MATERIAL.—The rail mills are starting in the year with a very good tonnage on their books, some of which is on old contracts made early last year. There has been no change in prices. In track material there is the usual demand, with prices unchanged. We quote the market on rails and track material as follows: Rails standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound, and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—Spikes,

2.50c; track bolts, square heads, 3.60c; hexagon heads, 3.85c; splice bars 2.50c to 2.60c; links and pins, 3c to 10c.

BARS.—The market is quite strong in steel bars. Mills are quoting from 2.25c to 2.40c, the latter only on small orders for very prompt shipment. Common iron bars are quoted at 2.15c in the valley and refined iron bars are held at about 2.40c, Pittsburg.

STRUCTURAL MATERIAL.—The outlook in structural material is very good. The mills had to carry over a considerable tonnage from last year, and have a good lot of orders on their books, considering the time of year. Practically all the mills have from two to three months of unfilled orders, and there is continual inquiry, so that a very good season is confidently expected. Prices remain as follows: Beams and channels 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees 2.30c; zees 2.25c; angles, 2.25c. Universal mill plates, 2.50c to 2.75c, according to delivery and size of order.

PIPES AND TUBES.—There is a fair running demand for tubular goods and mills are well filled with orders for their immediate requirements. Prices remain unchanged as follows: Merchant pipe, 50 and two 10's for car loads delivered within the specified territory; well casing, screw and socket joint, 37½; inserted joint, 32½, with an optional 5 per cent to dealers only; boiler tubes 1¼-inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron, and 55 per cent off for steel; 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b. mill.

PLATES.—The plate market is in about the same shape as noted last week. In some cases, on special inquiries, prices as low as 2.25c have been named on tank plate, but the general run of business is going at about 2.40c, while as high as 2.50c has been paid in some cases. We quote shell steel at 2.60c to 2.70c, flange, 2.70c to 2.80c and fire box 3¼c to 4c.

SHEETS.—Much talk is heard in the trade about the proposed consolidation and stories which are quite variant are going the rounds. There is considerable speculation in regard to whether any of the important interests will be left out. Nothing certain can be learned. The market is still weak, but mills generally are not willing to book for more than 60 days ahead. We continue to quote No. 28 gauge at 2.95c to 3c. Galvanized continues firm at 75 and 5 per cent off, with a 15-cent freight allowance, and some mills are asking as high as 75 per cent off.

SPELTER.—The spelter market has shown still further weakness since last report; the prime western grades can be had at from 4.40c to 4.50c, Pittsburg.

OLD MATERIAL.—Nearly all grades of scrap continue quite scarce, and prices are rather irregular. New basic melting stock is higher than at last report, and has sold at from $31 to $33. We quote the market as follows, Pittsburg, gross tons, except where otherwise specified: New Bessemer melting stock, $26 to $27; basic open-hearth scrap, $31 to $33; steel rails, mixed lengths, $22 to $23; short lengths, $23 to $24; iron rails, $29 to $31; cast borings, $14 to $15, net tons; cast scrap, $18 to $20; No. 1 wrought scrap, $24 to $25, net tons; busheling scrap, $16 to $18, net tons.

COKE.—The market continues quiet and uneventful. Prices are unchanged at $2.75 to $3 for Connellsville furnace coke and $3.25 to $3.50 for foundry coke. In the last week of 1899 the estimated production of Conellsville Coke was 188,920 tons, the holiday cutting it down from the 202,224 tons of the week preceding. The shipments of the week were 9,395 cars, or a decease of 2,088 cars from the record of the preceding week.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, Jan. 9.

The year opened with a quiet market, not a very heavy demand, and comparatively small sales of nearly all classes of material, although the outlook for the future is excellent. Considerable speculation is being indulged in over the probable course of prices, and a good many buyers appear to think there is a possibility of a decline in values before they are higher. With mills and furnaces sold for a long time ahead, and the first costs of material fixed at large advances over those of the previous year, there seems little likelihood of lower prices being made for some months, at least.

PIG IRON.—Not very much business was closed last week, and while one or two dealers report a good inquiry in hand, most of them say that the demand is still light, and is not likely to increase until buyers are assured that prices are as low as they will be. Furnaces are very firm in their views, as they may well be with their production taken for from four to six months ahead. It hardly seems likely, with the present strong natural conditions, that iron will sell lower than at present for the first half of the year, at least, and there are reasons for believing it will be worth as much for the last half of the year. Deliveries on old contracts are being called for by consumers even faster than the furnaces can make them, and most producers are behind on their orders for from two to six weeks. Foundries continue to use large quantities of iron, running full all the time. Quotations are unchanged as follows:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$20 85 @ $21 85
Local Coke Fdy. No. 1	25 00 @ 25 50	Southern No. 1 Soft	22 85 @ 23 85
Local Coke Fdy. No. 2	24 50 @ 25 00	Southern No. 2 Soft	21 85 @ 22 85
Local Coke Fdy. No. 3	24 00 @ 24 50	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	25 00 @ 25 50	Jackson Co. Silveries	32 00 @ 32 50
Local Scotch Fdy. No. 2	24 50 @ 25 00	Ohio Strong Softeners	24 50 @ 25 00
Local Scotch Fdy. No. 3	24 00 @ 24 50	Alabama Car Wheel	24 00 @ 26 00
Southern Coke No. 1	22 85 @ 23 85	Malleable Bessemer	24 00 @ 25 00
Southern Coke No. 2	21 85 @ 22 85	Coke Bessemer	25 00 @ 26 00

BARS.—It is reported that a meeting of bar iron and steel jobbers was held last week, at which an agreement was reached to maintain prices. From mill these are on a basis of 2.35c for both iron and steel, half extras, Chicago. The demand is not especially large, but good sales were made in this territory in the week, some of them of fairly large size.

RAILS AND TRACK SUPPLIES.—The demand is small, and sales were limited to small lots. Quotations are as follows: Rails, standard sections, $35 to $38; light sections $37 to $42; splice bars, 2.50c to 2.70c; spikes, 2.75c to 2.85c; track bolts, 3.65c to 3.85c.

BILLETS AND RODS.—The reported agreement on billet prices is denied by representatives of the mills. Prices are maintained at $35 for Bessemer billets and $36 for sheet bars, Pittsburg, and $2 a ton higher for Chicago delivery. Sales have been made at these prices within the week. Open-hearth rods are quoted at $65, and Bessemer at $55, and at these prices some sales have been made.

PLATES.—Business has been light, only small lots having been sold, and not very many of these. The demand is expected to be better within a short time. Quotations are not strong, but are expected to be firmer in the next few days. We quote tank steel from store 3.10c to 3.20c. Mill shipments Chicago delivery: Tank steel, 2.65c to 2.70c; shell, 2.75c to 2.80c; flange, 2.80c to 3c; marine, 3c to 3.10c; fire box, 4c to 6c, according to brand.

STRUCTURAL MATERIAL.—With the exception of a few small contracts no business was done in this market last week. Mill representatives report an excellent outlook for the future, but say the placing of orders may be delayed somewhat. It is regarded probable that prices of beams will be advanced within a short time. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates, 2.65c to 2.75c; universal plates, 2.75c to 2.80c; tees, 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

SHEETS.—The market is in fairly good shape, although most of the demand and sales were for comparatively small lots. The market is unchanged at 3c to 3.20c for No. 27 black sheets, and 70 and 5 to 70 and 10 per cent off for galvanized.

MERCHANT PIPE.—There was little demand last week, and only small sales, either for mill shipment or from store. Prices are unchanged at 50 and two 10's off for mill shipment on large orders, and 50 and 10 and 5 off on small orders.

MERCHANT STEEL.—Some business was closed last week, most of it in small lots, and the demand appears to be better than a week ago. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

WIRE AND WIRE NAILS.—Sales were good last week, notwithstanding the advanced prices, and the demand appears to be increasing all the time. Makers quote single carloads of wire nails at $3 53 f. o. b. Chicago, and $3.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.38; painted barb wire, $3.98; galvanized barb wire, $4.13.

OLD MATERIAL.—The market has been a little weak, and prices have fallen off somewhat, but dealers are looking for a stronger market and higher prices within a week or two. The demand is not especially large at present, and sales have been only small. Dealers' selling prices are revised as follows:

Old iron rails, gross,	$26 00@$27 00	Country malleable	$14 50
Old steel rails, long, gr.	23 50@ 24 00	Iron axles, net	$28 00@29 00
Old steel rails, mixed	19 50@ 20 00	Cast borings, net	10 00@11 00
Relaying rails, gross	28 00@ 30 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	22 50	Iron axle turnings, net	14 00@15 00
Railroad forge, net	24 00	Steel axle turnings	12 00@12 50
Dealer's forge, net	16 50@ 17 00	Mixed country steel, gr	15 00
No. 1 cut mill, net	14 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@ 15 00	Heavy melting steel, gr	19 00@19 50
Railway malleable, net	16 00	Old iron splice b., net.	26 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
127 VINCENT ST., Jan.10.

There has been some moderate buying of ore in the past week, some consumers who did not hurry into the market in December, having picked up portions of their requirements for the next 12 months. All in all the buying has been in excess of expectations, in view of the large advance made. The statistics of unsold ore on Lake Erie docks show that the amount is the smallest in years, being only about 200,000 tons in December as compared with more than four times that amount twelve months before. It thus appears that more than 19,000,000 tons of Lake Superior ores went to buyers in 1899. The present movement from docks to furnaces is still restricted somewhat by lack of cars, and it has been demonstrated recently that with all the large direct shipment in the past season furnaces were not able to get well assorted stocks in their yards and must keep in close touch with dock supplies through the winter.

PIG IRON.—Though quiet the market in all grades shows strength. Some of the furnaces represented in Cleveland have been asked by foundries to increase their deliveries, several cases being reported in which foundry operations must be curtailed or interrupted if more iron cannot be had. There are indications in a good many directions of an extension of foundry operations and the consumption of foundry irons in this territory will be much larger in the next six months than in the second half of 1899. In gray forge there is scarcely enough business to make a market, but $21, valley furnace, is the nominal basis. Bessemer iron is quiet and promises to remain so for some time. For spot shipment 25c to 50c over $24, valley, could readily be done. While the Shenango steel plant of the National Steel Co. is shut down for repairs iron from the New Castle furnaces is being sent to Youngstown to keep the Ohio works in full operation. We continue our former quotations:

Bessemer	$24 90	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@ 23 50	Valley Scotch No. 2	22 50@23 50
No. 2 Strong Foundry	22 50@ 23 00	Gray Forge, valley	21 00@21 25
No. 3 Foundry	21 50@ 22 00	Lake Superior Charcoal.	25 00@26 00

FINISHED MATERIAL.—The mills give no sign as yet of any necessity for going after business, and the fact that prices are so steady under a two months' wait is taken as promise of a firmer market very shortly. In structural lines the most important pending business is an 850-ton contract for a Toledo building. Architects continue to speak of building work held up by high prices, but the chances are greater for a further advance than for a decline in structural shapes. Bars hold their own and the leading producer of bar iron is reported to have more orders booked and more specifications in hand today than at any time. Stocks in jobbers hands have not gone down very fast, but the attitude of the mills seems to be the key to the situation, the latter having taken a very firm stand. On some sizes it is unable to promise deliveries for more than six months. We still quote 2.15c, valley mill, for common iron in carload lots and 2.25c, Pittsburg, for steel. Some plate mills are comfortably booked but others are more eager for business. As low as 2.25c, Pittsburg, is heard, but 2.40c is more common on small lots. Sheet mills will not book for delivery beyond 60 days as a rule and sentimentally at least the sheet market is stronger. We quote No. 28 at 2.90c, Pittsburg, with some mills asking $1 more.

OLD MATERIAL.—During the wait the market is somewhat weaker on commoner forms of scrap and on material in cars that must be moved, but in general buying is light. We quote No. 1 railroad wrought scrap at $24; machinery cast scrap, $17; busheling scrap, $15.50 to $16; iron rails, $28 to $29; wrought turnings, $14; cast borings, $12 to $13.

WIRE AND WIRE NAILS.—A demand for an advance averaging 12½ per cent over 1899 in rod mill workers' wages is pending, though the company voluntarily gave 7½ per cent Jan. 1. The outcome is not sure but it is believed that the matter will be compromised with no interruption in operations. The outlook for a large wire and nail demand in the spring is excellent. We quote wire nails at $3.35, Pittsburg mill, in carload lots to retailers and $3.20 in carload lots to jobbers; smooth wire, $3.05 in carload lots to jobbers and $3.20 to retailers; barb wire, $3.75 for painted and $3.80 for galvanized to jobbers, with 15c advance to retailers. Freight to Cleveland to be added.

PHILADELPHIA.

Jan. 9.

The fact that prices have held under the comparative quietness of the past six weeks is an evidence that the situation is one that does not warrant a lower basis. It is considered further to be an indication that when buying starts again in good volume, as it may do bfore the present month is out, it will quickly appear that even somewhat higher prices for a time are not an improbability. The little business done since the opening of the year has been at full prices. The outlook for the year from the foundry standpoint is excellent, large contracts for castings being in hand, but as a rule founders in this territory have sufficient iron coming to them on their contracts to make them comfortable for some time to come. Much turns on the course of the market in the next three weeks; at the moment the chances of lower prices for pig iron seem quite remote. If buyers wait five or six weeks longer, the conditions might be different. Any iron that is offered below the general level either proves to be of the untried or the less desirable grades or deliveries are some distance ahead. We continue to quote $25 to $25.50 for No. 1X; $23.25 to $24.25 for No. 2X; $22.25 to $22.75 for No. 2 plain; $20.25 to $21 for standard mill iron, and $22.50 to $23 for basic. Business in Bessemer billets is still in suspense. There is prospect of a good demand and there seems less prospect than heretofore that buyers will be able to improve on present quotations which are $37.50 to $38. In rolled material the demand is good for everything on the list, yet prices are not firm, with mills generally supplied with work for some weeks to come. Plates still show a wide range, as low as 2.25c being reported for ¼-inch up to ¾-inch; but this is extreme and as high as 2.50c and 2.60c is quoted. The mills are becoming better satisfied that a large demand for plates is ahead of them. For ordinary iron bars some mills have got down as low as 2c and 2.10c; for refined iron the association figure is 2.20c. We quote steel bars at 2.50c. The outlook for structural material is considered good and prices remain on the basis of 2.40c, Philadelphia or nearby delivery, for beams and channels up to 15 inches wide. Sheets continue quiet. For the best grades, one pass through cold rolls, No. 28 are quoted 3.40c, common black sheets being 3.25c to 3.30c. In old material the situation is complicated by the necessities of parties who have to move stock immediately, consequently material of this kind has to be sold at almost bid prices. Buyers who require some special article, which is not in the class mentioned, have to pay full prices, and no one sells at inside figures, except under necessity.

CINCINNATI.

Jan. 9.

Matthew Addy & Co. say: "There are signs of a decided renewal in inquiry. The best feature of the present inquiries is that they come from no one territory but from all parts of the country, and they are from all classes of consumers. The mills which have been keeping out of the market for some little time are not as well supplied as they thought and the chances are that before long there will be a demand for forge iron beyond the capacity of the furnaces to supply. In midsummer there was a genuine shortage of soft irons, but this no longer exists. Hard mill irons, however, are most decidedly short, and as stated the prospects for an adequate supply are anything but flattering. As a matter of absolute fact, speaking of Southern iron, even a fair buying movement for deliveries this side of July would soon put every grade out of the market. This is a mere matter of statistics

and anyone who has the figures at hand can speedily convince himself of the truth of this statement. The buying druing the week has been fair, though featureless. The genuine feature of the present time is the requests for anticipation of shipments on contracts calling for deliveries not yet due, and the demand for faster shipments on current orders."

Rogers, Brown & Co.'s weekly market letter says: "The serenity of the market the preceding week has prevailed through the first business week of the new year. It is gratifying to furnaces that the demand has lessened. Most of them are sold ahead for from four to eight months, and are unable to adequately comply with requests for shipments. The interruptions at the furnaces occasioned by the holiday celebrations referred to in our last report were more serious than then known. The majority of the Southern furnaces were banked for the full week. In the North several important stacks have been quiet, owing to insufficient coke supply. The curtailment of product for the period is felt by many consumers depending upon these various stacks for their pig metal. Manufacturers, and foundrymen generally, express the belief that the volume of business the coming year will exceed that of 1899, and while many of them are provided under contracts with pig iron for two, four, or six months ahead, a large number will be obliged to purchase immediately. One manufacturer informs us that he has just made a canvass among his customers as to their probable requirements the coming year for his goods which resulted in an expected increase of 100 per cent. Notwithstanding that fully 125,000 freight cars of enlarged capacity were built during 1899, many of the railroads are unable to handle traffic promptly. The difficulty attending satisfactory coke deliveries is the want of cars, and the record has been made frequently of late, that orders have been refused because of inability to ship the coke."

Prices are well maintained throughout the entire list. We quote for cash f. o. b. Cincinnati: Southern coke No. 1 foundry, $21.75 to $22.25; Southern coke No. 2 foundry, $20.75 to $21.25; No. 3 foundry, $19.75 to $20.25; No. 4 and gray forge, $19.25 to $19.75; No. 1 soft, $21.75 to 22.25; No. 2 soft, $20.75 to $21.25; Lake Superior coke, No. 1, $24 to $24.50; No. 2, $23.50 to $24; Hanging Rock charcoal, No. 1. $25 to $26; Jackson county silvery, No. 1, $30 to $31; standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25.50 to $26.50.

Philadelphia Foundrymen's Association.

The New Year dinner given Wednesday evening Jan. 3 at the Manufacturers' Club, Philadelphia, by the Foundrymen's Association was attended by 75 guests, of whom a number came from outside points. President Thomas I. Rankin, of the Abram Cox Stove Co., made an address of welcome and P. D. Wanner, of Reading, a former president, spoke of the gratifying condition of trade. Geo. H. Hull could not be present and his paper on pig iron buying and selling systems was deferred to the association's next meeting. E. E. Brown, of Philadelphia, spoke briefly of his experiences and observations on a recent trip abroad.

H. Rotherham, of Melbourne, Australia, was called out and spoke of labor and industrial conditions in Australia. Though without foundries and having few manufactories, his country exported largely its raw materials.

The executive committee presented its report through Secretary Evans. It referred to the fact that foundries are busy in England and Germany and other countries, and especially so in Canada and the United States. The year 1900 is expected to exceed all other records. "Some of our large foundries are filled with orders for castings to such an extent that they are making inquiries from other foundries to help fill out their orders. The price for pig iron and scrap and other material seems to be as high as at any time, with no prospect of reduction. We would, therefore, urge that they demand a price for their castings commensurate with these conditions."

S. T. Wellman and C. H. Wellman, Cleveland; F. J. Hearne, of Wheeling; J. E. Schwab and B. F. Wood, of the Carnegie Steel Co.'s works, and J. Weidman Murray, of Pittsburg, are named among recent visitors to the newly started steel plant of the Alabama Steel & Shipbuilding Co., at Birmingham, Ala.

FUTURE OF THE STEEL RAILROAD TIE.

We have commented recently on the employment of steel ties as a substitute for wooden ties and upon the demand likely to come from this source as the next important extension of the use of steel. The *Railway Review* has the following on the same subject from the standpoint of railroad experience:

The experience of the Mexican Southern Railway with steel ties has been so satisfactory that the entire line will now be equipped exclusively with these ties. The extent of the experiment with steel ties in this instance has covered more than half the mileage of the road, and as both steel and oak ties have been used at the same time it must be inferred that the conclusions which have decided in favor of the steel tie have been fairly arrived at. The track on both of the roads here referred to is narrow gauge, which is all the more favorable toward the steel tie, as the rolling stock is presumably lighter than that of the average standard guage road and, for a given thickness of metal, the shorter tie is the stronger in case of center binding. Nevertheless the element of strength is not the only consideration in any test of the efficiency or economy of steel ties.

The points of chief interest to be noted about these steel ties is the small cost of miantenance, compared with such cost where wooden ties are used, and the kind of ballast which has proved to be most satisfactory. According to the official statement the cost of maintaining track where the steel ties have been used is only 50 per cent of the cost where the ties have been wood. We would have liked to see this cost analyzed, so as to be able to ascertain what portion of the same was due to the expense of tie renewals and how the cost of surfacing track laid with steel ties compared with that of track laid with wooden ties. We have heretofore expressed ourselves unfavorably toward the inverted trough type of steel tie, believing that a tie having a flat bottom face is much better adapted to the conditions of embedment and the operations of tamping than a tie which is hollow on the under side. But we have also tried to make clear the important fact that the continual disturbance of tie imbedment, even at such intervals as obtain with wooden ties of average life, cuts a very large figure in the expense of maintaining track in surface. It may be, therefore, that although the inverted steel trough is ill adapted for ready imbedment, yet the freedom from disturbance after it does become firmly embeded and placed in proper surface, due to its long life, may effect such a reduction in cost of surfacing the track as to work an ultimate economy in this respect. In fact, it appears that such an explanation is to be found in the facts as stated in this case, for one of the disadvantages cited for the steel tie is "the longer time required to obtain good alignment and surface on new track;" while among the advantages named we find that "line and surface are better preserved." In connection with the matter of deterioration of the ties it is important to note that the condition which operates most destructively upon oak, namely, damp climate, might be expected to act with measurable severity upon the steel ties also. Nevertheless we are informed that during nine years of service under these conditions, on the Interoceanic road, the steel tie has not deteriorated appreciably. Attention is called to the necessity for applying a preservative coating, but as coal tar seems to answer the purpose the cost of treatment is comparatively inexpensive.

Regarding ballast, the experience of these Mexican roads is contrary to what is reported of results obtained in most countries where steel ties are used to considerable extent. On each of the roads here referred to the officials emphatically declare that broken stone ballast of the size ordinarily in use is not suited to the maintenance of track laid with steel ties. How well a finer size of broken stone ballast would answer is not stated, but gravel and sand seem to be preferred in any case. This experience seems to corroborate the results obtained with the Hartford steel tie on the New York Central Railway, where broken stone ballast has been used. The cost of maintenance has been excessive, and it has been difficult to keep the track in good alignment. The explanation which most readily suggests itself is that broken stone, being less mobile in character than gravel or sand, is not so readily tamped into the hollow of the inverted trough tie; but why the relative merits of these different kinds of ballast as used with steel ties in other parts of the world, have not been recognized inthe same way is not generally understood, we are inclined to think, and to find the explanation no doubt offers opportunity for profitable study.

THE IRON AND STEEL STOCK MARKET.

Denison, Prior & Co. say in their weekly letter on the iron and steel stocks: "It is a market of rumors and it seems that the more senseless the rumor the greater its effect on quotations. If a one-sided market is interesting the present markets, by comparison, must be of surpassing interest to the most blase observer, as there are as many sides as there are hours to the session. All stocks are affected; the international issues, however, show the greater amount of nervousness. The preferred issues of the steel stocks remain comparatively steady, with but few transactions. The common shares are more variable. A bull pool is said to be at work in Steel and Wire common, but up to the present time their efforts to force the stock to higher prices have not been very successful. The immediate future of the market depends upon the political complications in Europe and the success or failure of British efforts in South Africa. If any one can make the right guess on these important events he can foretell the course of the market. We do not pretend to predict the result, but apart from all such considerations cannot help but feel that the preferred steel stocks are good investment propositions at current quotations."

Fluctuations of the Week and the Year.

The table below shows the changes in the iron and steel stocks in the week ending Jan. 8, also the high and low points of last year:

Name.	WEEK.				YEAR OF 1899.			
	Open	High	Low	Close	High.		Low.	
Am. Car & Fdy.....	13⅜	14¼	13½	13⅝	27⅜	May 25	10⅝	Dec. 22
Am. Car & Fdy pr.	59⅛	62½	59⅛	62	68⅜	Sept. 7	51	Dec. 22
Am. Steel & Wire..	49	50⅛	46⅛	47⅜	72	May 4	32	Dec. 18
AmSteel & Wire pr	90	91⅞	90	90⅜	106¾	Mar. 13	84	Dec. 22
Am. Steel Hoop.....	43⅜	45	43	43⅞	48¾	Nov. 28	24	May 24
Am. Steel Hoop pr	82½	83	81⅛	82	86¾	Sept. 14	70	May 13
Am. Tin Plate.....	29	34⅛	29	29¾	52¾	April 4	20	Dec. 11
Am. Tin Plate pr..	83	83	80½	80½	99⅝	Feb. 8	74	Dec. 22
Col. Fuel & Iron...	44¾	46½	40½	42	64	Sept. 11	30⅛	Feb. 8
Federal Steel.....	54⅛	55¾	50⅝	52	75	Apr. 3	39¾	Dec. 18
Federal Steel pr....	75	76	73	73	93⅛	April 3	67	Dec. 22
National Steel.....	44	46⅜	41	41½	63	April 24	31¾	Dec. 19
National Steel pr..	91	91	92¾	92½	99⅜	Aug. 11	85	May 15
Pressed Steel Car..	56½	58	56⅛	57½	81	Aug. 14	44¾	June 1
PressedSteelCar pr	86½	86⅛	86	86	91	Sept. 7	75	Dec. 18
Republic Steel.....	21	23¾	20¾	21¾	33⅞	Sept. 6	16½	Dec. 19
Republic Steel pr..	66	68½	65¾	65¾	79	Aug. 9	60½	Dec. 19
Tenn. Coal & Iron	83⅛	87⅞	82	84⅛	126	Sept. 11	36	Jan. 14

Notes.

A statement by an authority on the affairs of the Pressed Steel Car Co. has this: "The Pressed Steel Car Co. has on its books nearly $20,000,000 worth of orders, and the new plant just completed will give the company a capacity from $2,500,000 to $3,000,000 a month. The net earnings of the company for the fiscal year were equal to a sum largely in excess of the amount necessary to pay a dividend on the common stock, and the sentiment of the board is unanimously in favor of the declaration of the dividend on the common stock next month."

The American Car & Foundry Co.'s directors at the meeting at St. Louis last week declared a quarterly dividend of 1¾ per cent on the preferred stock, payable Feb. 1. One of the directors says that it was decided to accumulate a surplus of $4,000,000 to $5,000,000. Net earnings in nine months have been $2,717,412, and there are contracts to occupy all plants for five months. It is expected the year's net earnings will yield $2,000,000 for surplus.

The Federal Steel Co.'s directors met Jan. 9 and declared 1¼ per cent dividend on the common, this to go to the stockholders of record last July. In February it is expected that another 2½ per cent will be declared.

The directors of the American Steel Hoop Co. met Jan. 9 and declared the third quarterly dividend on the preferred stock, payable Feb. 1. Unofficial statements continue to be made, that a dividend on the common stock is expected at the close of the fiscal year.

A New York dispatch has the following concerning the earning power of the Lorain Steel Co.'s furnaces and steel works: "The Lorain steel plant, at Lorain, O., which was one of the concerns acquired by the Federal Steel Co. shortly after its organization, has earned at the rate of about $350,000 net each month of the past fiscal year. As the contract price for its output is now larger than during the first months of the year, the earnings are proportionately greater. During the month of November the net income of the Lorain property was $495,000. During the year this plant has earned enough net to entirely pay for the land upon which it is located and the plant itself."

Directors of the American Tin Plate Co., have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Jan. 31. Books close Jan. 22 to 31, both inclusive.

LAKE SUPERIOR IRON MINES.

The Cleveland-Cliffs Iron Co. declared its quarterly dividend of 2 per cent last week.

The Commonwealth Iron Co. is opening up a new mine at Commonwealth, Mich. It is about one-fourth mile northwest of the company's Badger mine. A shaft has been driven 40 feet through clean ore, the vein at this depth showing a width of 30 feet with evidence of widening at a greater depth. Drifting has been in progress for the past month and the drift is now 75 feet in ore, no rock having been encountered. Analyses of samples from the 100 tons shipped thus far show that the ore exceeds 60 per cent in metallic iron and is of somewhat better quality than the company's well-known Badger ore. It is hoped to have a shipping mine early in the coming season.

J. D. Gilchrist, who has been superintendent of the Mountain Iron mine for several years, has been promoted by the Oliver Iron Mining Co. to the assistant superintendency of its properties, making his headquarters in Duluth. It is stated that T. F. Cole, general superintendent of the company's mines, will have his headquarters in Duluth hereafter, instead of at Ironwood, Mich.

The American Mining Co. (American Steel & Wire) has purchased the Consolidated mine on the Cascade range. The mine was known for a time as the Mesabi Friend and was operated two years ago by J. H. Quinn and others of Ishpeming. The ore is silicious, running 39 per cent in iron and is of Bessemer grade.

J. J. Hill has given a lease on a large tract of the Wright & Davis lands, which he acquired about a year ago in connection with the purchase of the Duluth, Mississippi River & Northern Road, to Corrigan, McKinney & Co., of Cleveland, the deal being closed last week. The lease is reported to include the greater part of the Wright & Davis holdings which in all were 5,000 acres. The Mahoning mine was at one time a part of these lands. Numerous bodies of ore have been proved up by drill explorations, the most important being in 57-12 just southwest of Hibbing. Here drill and test pit work has shown a continuous ore body for a mile. The new property is a stripping proposition and it is expected shipments will be made next season. The ore is of Bessemer grade and is represented as of the coarser Mesabi variety.

At the Auburn mine a new stripping contract for 500,000 yards is to be carried out in the coming year.

The Oliver Iron Mining Co. has taken an option to purchase what is known as the Jeffrey property, situated in 58-18, near Mountain Iron, Minn. The option was originally given by H. H. Phillips, Jeffrey Bros., Hanson E. Smith and others, to another party, who has since assigned to the Oliver company. There are four forties in the Jeffrey tract and a large body of ore has been found.

THE partnership between John W. Hoffman and Ernest Law, under the firm name of J. W. Hoffman & Co., Philadelphia, has been dissolved. Ernest Law is the liquidating partner. The business of iron and steel, coal and coke will be continued in the Harrison building, by Ernest Law, under the firm name of Ernest Law & Co., by whom all contracts made by the firm of J. W. Hoffman & Co. are assumed. The new firm will continue the agency for the Lebanon Furnaces, Lebanon, Pa., and by recent appointment will act as the Eastern representative of M. A. Hanna & Co., of Cleveland, for the sale of their ores. The Hoffman Engineering & Contracting Co., J. W. Hoffman, president, will continue the business of engineering and general contracting in the Harrison Building.

An advance of 5 per cent was made Jan. 1 in the wages of employes at the Dunbar Furnace, Dunbar, Pa., and at the Semet-Solvay coke plant of the same company.

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AND
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1900 AS A YEAR FOR THE FOUNDRY.

The expansion in the demand for foundry iron in the past 12 months has been an interesting study to an important element in the iron trade. While all the 600-ton furnaces whose construction was completed, started or projected in 1899 belong in the Bessemer column, it is well known that with an occasional exception the 80 or 90 old furnaces that became active last year were started up to produce non-Bessemer iron—in nearly every case, foundry grades. This great addition to capacity meant a veritable revolution from the conditions of 18 or 20 months ago when foundry furnacemen were holding meetings in the East to devise some scheme to limit production and save themselves from ruin.

The foundry trade has proved a reliable index to well diffused prosperity, and its record in the past year has probably not been equaled. About a year after the great crops of 1896, the malleable trade got the first effects of the turn in the fortunes of the American farmer. The next year the movement increased, having meantime been augmented by the railroad buying that was itself the fruit of agricultural prosperity. The exports of American machinery made further demands upon the cupola. And as the furnaces, rolling mills and steel works began getting in shape to respond to the demand that was rising from every quarter they completed the circle by their requisitions for the large tonnage of castings required to start up the inactive, equip the new and re-inforce and enlarge the rest. As all industry was quickened by the large crops and the large exports and the inflowing gold of the three years following '96, machinery of all descriptions was in demand, and foundrymen who believed the days of a fair profit on castings had departed never to return found themselves courted, while for the privilege of naming the time of delivery customers offered figures not paralleled in years.

How the foundry trade has been responding has been evident in every quarter. Melting capacity has been greatly increased by the putting in of new cupolas. The building of new foundries and the enlargement of the old has been steadily pushed since the spring of 1899. Busy concerns have put out work right and left where those not so crowded could be found to take it on contract. Idle foundries have been looked up and leased—these often being in other cities. New foundry construction has been pushed in every section. Malleable and steel foundry construction has had an impetus not known in years. But gray iron, machinery and general jobbing foundries have been even more conspicuous in the revival. Foundries working in a limited way on a specialty have widened out into the general jobbing field and have taken contracts never before considered within their capabilities.

It has been said in the past few months that the high prices of pig iron were likely soon to affect foundry operations, as high rolled products were bound to limit building and other operations. But indications are—and these appear not in individual instances but in a multitude of cases in many directions—that the foundry demand for iron in 1900 will be materially in excess of that for 1899. Much of the additional cupola capacity referred to was only completed late in the year, for contracts taken to run months ahead. Even with so large a furnace capacity available as that which is now active, there is everywhere such a call for iron by the foundries as indicates that a day's banking of all the furnaces supplying them would cause a serious dislocation of operations. The rule with foundrymen as with furnacemen is that their full capacity is booked for months ahead.

Foundries like those making malleable for the agricultural trade, and those connected with implement concerns have no means of knowing now how their melt for 1900 is likely to compare with that for 1899. They must wait to see how the machinery that has been built for this year's market moves off at the higher prices which necessarily must be asked for it. But in railroad malleables, in gray iron castings, machinery castings, mill and heavy work and the miscellaneous product of the jobbing foundries, all the preparations of the past half year and the known calculations of many prominent foundries point to the largest tonnage by far of cupola metal in 1900 the country has yet known.

FUTURE OF OLD RANGE BESSEMER ORES.

In referring to the heavy drafts upon the choice Bessemer ores of Lake Superior and the failure to find new ore bodies of these grades, it was pointed out in these columns recently that the Mesabi range must be regarded as the real base of the Bessemer steel column and that because the way must be found for using larger percentages of its ores the way will be found. Joseph Sellwood, who has had large experience in iron mining and is fully acquainted with the Lake Superior situation, said in a recent interview that the Mesabi shipments, which were 26 per cent of the whole in 1895, were about 40 per cent [37—ED.] in 1899, or 5 per cent

more than in the preceding year. On the general question of old range supplies Mr. Sellwood said to a correspondent of the *Iron Age:*

There has been a wonderful amount of exploration and development the past year; and what has it shown? There are today more ores in sight than ever before, but with this qualification—that we are including such ores as we did not figure on a few years ago. The high grade Bessemer ores of the old ranges are getting scarce, and they are taking today lean Bessemers, high phosphorus ores, and in this way are bringing to bear an enormous tonnage that was not counted. There is a very large amount of ore in Marquette County, for instance, that runs better than 40 per cent iron and low in phosphorus, and that is now valuable. Then the neglected high phosphorus ores of the Menominee are now in demand. There is only one new mine shown on the Gogebic this year, the New Davis, and it is not what it might be. Drill after drill has been worked on the Vermillion this year, but there are no deposits shown that were not known in 1886. Of course here, as everywhere else, the limits of ore bodies have been extended and the tonnage in sight greatly magnified by thorough search, but of new bodies found there are few. On the Mesabi, for example, a great volume of what might be called new ore is now passing into the hands of big companies, but it is ore that has been known of to some extent for years; most of it was found in 1892 and 1893, and dropped out of sight then because of temporary conditions. The ore now being opened into on the Menominee is mostly in old mines that were abandoned years ago, but that new conditions have brought into play again. However, there is far more ore on these ranges than most people think, and I do not suppose it has all been found yet by any means.

That prophecy on this subject has been confounded Mr. Sellwood showed by reference to some earlier predictions of speedy exhaustion. But he emphasized again the statement that larger supplies will come from the old ranges only because material is used that was once thought valueless. For the high grade Bessemers the ultimate dependence is on the Mesabi. Much in the same line is this recent expression of Geo. A. Newett, of Ishpeming, Mich., until last year Commissioner of Mineral Statistics for the State of Michigan:

The estimates of the ore which can be produced by the old mines of the Marquette range, do not show as high a tonnage as sent out during the season just closed. There was considerable ore sent from stockpiles carried over from other years in the record for 1899, while little ore remained at any of the mines at the end of the recent season. The large mines are working to their fullest practical capacity. There could be gains made at some of them, but it might be at the expense of future outputs. There will be several small mines reopened, but their combined output will not be large. Many of them are a little more than explorations, and are not expected to yield much ore in the present year. There has to be a great deal of "dead" work done in the mines of this county at the conclusion of each active season. The big properties have been wrought for many years, they have grown steadily deeper, and new levels must be added and a great deal performed to arrange for new stock piles It was different when the deposits were nearer surface. This not only requires time to perfect, but it takes money as well. Mining companies which have been working forty years have to do a wonderful amount of figuring and planning to keep their ore reserves up to the required proportions. All these millions make sad holes in reserves and it is certainly a fact that old lenses are giving out as new ones are discovered, and the late additions are of less proportions than the old. Of course we are going to be in the iron ore mining business for many years to come, but the maximum of production has been reached. We may exceed last season's work a little, but no big gain can be expected. And what is true in this respect of the Marquette range may apply with equal force to the Menominee and Gogebic ranges. We have plenty of low grade ores, millions upon millions of tons of those of the highly silicious class, but of present "standards" we can look for no prolonged increase over last year's performance.

A Great Year in Connellsville Coke.

(Special Telegram.)

Pittsburg, Pa., Jan. 10.—The production of Connellsville coke last year was about 10,000,000 tons against 8,460,112 tons in 1898. The annual meeting of the Frick Coke Co. was held at Scottdale, Pa., yesterday, and the old board of managers was re-elected.

Personal.

D. G. Kerr, superintendent of blast furnaces at the Edgar Thomson works at Braddock, has been appointed assistant to James Gayley, of the board of managers of the Carnegie Steel Co., Ltd. Mr. Kerr will be head of the Edgar Thomson works department with office in Pittsburg. Heads of the various departments at Edgar Thomson gave Mr. Kerr a number of remembrances, including a gold watch and chain. G. G. Crawford becomes superintendent of Edgar Thomson furnaces.

The annual banquet given by the Carnegie Steel Co., Ltd., to the heads of various departments was held Saturday night, Jan. 6, at the Hotel Schenley, Pittsburg. There were 64 guests, including the wives of the officials. President C. M. Schwab was master of ceremonies and H. P. Bope officiated as toastmaster. Responses to toasts were made by C. M. Schwab, W. B. Dickson, L. T. Brown, G. D. Packer, James Scott and John McLeod. Others present were: A. R. Peacock, L. C. Phipps, W. E. Corey, Thomas Morrison, J. E. Schwab, James Hunter, Emil Swenson, Charles McCreary, Superintendent Hempfeld, Homer Lindsay, H. E. Tenner, D. Clemson, James Gayley, A. M. Moreland, George McGrew, D. G. Kerr, A. C. Dinkey, E. P. Wood, F. H. Kindl, W. R. Balsinger and George McCague.

Andrew Carnegie arrived in Pittsburg Sunday evening, for a stay of several days.

Ward Hunt Dean, superintendent of the Dean Bros. Steam Pump Works, Indianapolis, Ind., died in that city Jan. 3, aged 50 years.

Wage Advance by American Steel & Wire Co.

With the new year, the American Steel & Wire Co. voluntarily increased wages of its employes in its mills by 7½ per cent, at the same time inaugurating a system of setting aside 2½ per cent additional to create a special fund for the benefit of employes. This makes the increase virtually 10 per cent. The fund is to be controlled by the employes themselves. The notice of the advance reads as follows: "We take pleasure in advising you that at a meeting of the executive committee of this company a general advance in wages of 7½ per cent has been decided upon, affecting all tonnage, day, hour and salaried mill employes, going into effect on Jan. 1, 1900, until further notice. It has also been decided in addition, to set aside a cash sum equivalent to 2½ per cent of our total mill pay rolls for 1900, to be used for a special benefit fund applicable to our mill employes, in such equitable rates as a committee to be appointed later on may decide." First Vice-President Edenborn is thus quoted concerning the new benefit fund: "This fund for insurance purposes, comes out of the pocket of the company. We will do this to show the men how the plan will work, and at the end of the year we will ask them to give a like amount of their wages. We will continue to give that amount, which will make the fund 5 per cent. We are prospering and we wish the men to enjoy our prosperity. We raised their wages several times last year. We simply believe in being fair. If we were losing money we would ask them to accept a reduction in wages, but, happily for all of us, we are doing well." The company has in its employ 26,000 men.

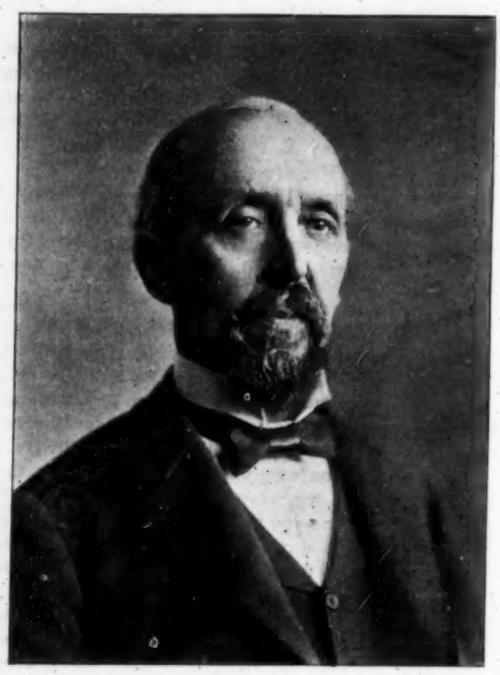
THE first 500 foot vessel built on the lakes will be launched at the yard of the American Shipbuilding Co., at Lorain, O., Saturday, Jan. 20. It will be named for John W. Gates, of Chicago, chairman of the American Steel & Wire Co., and Mrs. Gates will christen it. The new boat will be 478 feet keel, 52 feet beam and 30 feet deep, equipped with quadruple expansion engines. This is one of the four 500-foot vessels now building for the American Steamship Co., in which the officials of the American Steel & Wire Co. are large stockholders.

SELF-ADVANCED FROM THE RANKS.

James H. Baker, Designer of Wagon Hardware.

Manufacturers whose careers have been contemporaneous with the development of an industry are fewer in number as the organization of manufacturing industries becomes more complex, and the days of beginnings are lost in the distance. Yet in not a few lines the pioneers, still far from old, are bearing an important share in the extension of the business which they established and to which largely they have given their present form. In connection with the career of James H. Baker, vice-president and general manager of the James H. Baker Mfg. Co., of Pittsburg and Tarentum, Pa., are many things typical of the experiences of that class of manufacturers who have started at the bottom and achieved much in the face of many obstacles. Asked to give some data concerning his early experiences in the industry to which he has contributed a number of well-known products, Mr. Baker recently gave the writer the following, in substance:

"I was born 56 years ago and learned blacksmithing under my father in Shenandoah Co., Va., where he still works at making knives and small edge tools. It must be remembered that in the mountains of Virginia the country was far behind Pennsylvania and the North for improvements in manufacturing, and therefore we had to do by hand many things which were done in the North by machinery. The first iron I helped



JAMES H. BAKER.

to work was made from pig iron in a forge which had neither a blower, fan, belt nor gear wheel. The iron was refined in a flat open top hearth, with charcoal, the blast being furnished by a water trompe, called a 'tromb' by the men. The hammer was a trip hammer worked by trips on a water wheel shaft. I would take my father's wagon and stay all day getting about a ton of bars. Outside of a few special shapes for plows, etc., the only shapes we got were tire bars, each tire in two lengths, and rough flat bars 3 inches to 4 inches wide by ⅜ to ½ inch thick. Out of these we ironed wagons, no factory wagons being sold there, made horse shoes, and nails, plows, axes, chisels, drawing knives, harness irons, bolts and nuts, chains, rivets, washers and wagon and other farm implement fittings generally.

"The war swept that country clean, and when I became old enough to look out for myself, th epoor conditions still prevailing there, I heard what was to me exciting news. This was of a section where there were rolling mills and great factories, and I at once determined to have some share in them. I moved to Ohio and started business in a blacksmith shop 18x24 feet. Among other things I made axes and rented a grindstone and emery wheel at a plow factory about four miles away, where I finished these, doing much of this work at night. I next bought a single horse power, and a large grindstone, when things went some better. In the meantime, I ironed a wagon now and then by hand. I next bought a 6 h. p. boiler and engine, when I added a blower, one Bradley hammer, punch and shear and a wood working tool or two. The engine I ran mostly myself while working at the blacksmith forge. Next I got a larger boiler and engine and more machinery. By this time I was buying car lots of wood stock and wagon hardware. One day a salesman from Ft. Wayne, Ind., said to me, 'make a good single tree clip and you can sell all you can make.' A day or two after a salesman from Galion, O., said substantially the same thing. I got him to send me a lot of clips and I studied them, and the result was the 'Baker clip.' To this article I owe a great deal of my standing with the hardware trade and with wagon blacksmiths.

"I finally sold out the wagon business and came to Pittsburg where I went into the Baker Chain & Wagon Iron Co. in which I spent four busy years, having of course left the anvil behind me. It was in this company that I got a wider view of the manufacturing field. Among other things we got an order from the Government for a large quantity of 2-inch cable chain. This had to go through a rigid inspection and severe tests, the tests of samples being made at the U. S. Arsenal, Watertown, Mass. This gained me access to the U. S. Navy Yards and gave me opportunity to learn much in many ways."

Mr. Baker sold out his interest in the Baker Chain Co., in 1890, and in 1894 organized the Baker Forge Co. This company made nearly all the forgings for the Pressed Steel Car Co., of Pittsburg, and the latter company bought the plant last year. H. M. Brackenridge and Mr. Baker then organized the James H. Baker Mfg. Co., which manufactures wagon hardware and railroad forgings. New designs of work and new methods of manufacture have been developed by this company.

The Pig Tin Market.

Charles S. Trench & Co., of New York, send out the following statement concerning pig tin:

Estimated stocks on spot New York, Philadelphia and Boston,	900	tons.
Afloat, from East Indies including all shipments to Jan. 1, (actual),	1,440	"
Afloat from Australia, (actual),	50	"
Afloat from England, shipments to Jan. 2, (actual),	425	"
Afloat from Holland, shipments to Jan. 2, (actual),	200	"
	3,015	"
U. S. consumption during 1899 averaged 2,600 tons per month.		
We estimate consumption January and February, for each month,	2,600	"

As the above East India shipments cover all the supplies that can arrive by March 1st from this source, we estimate that we must draw from the London stocks in addition to the 630 tons already afloat from Europe, 3,080 tons during January and February, provided stock March 1st is to remain at 900 tons same as at present. It is interesting to note that during the last two weeks of December spot tin commanded a premium of 1 to 1¼c per pound over future deliveries and cost of import as the result of depleted condition of spot stocks. This depletion of stocks has extended also to the invisible supply in the hands of consumers, who are completely bare of supplies. The scare that has existed in pig tin for two months has brought this about, as also the small shipments to this country from the East, as shown by the amount afloat. The present price is 25.15c to 25.25c for spot shipment and 24.85c to 25c for January and February shipment.

THE organization of wire rod workers in the Central West has presented to the American Steel & Wire Co. a request for an advance of 12½ per cent in wages, or 5 per cent more than the advance made voluntarily by the company on Jan. 1. A conference between officers of the company and officers of the union was held at the Hollenden Hotel, Cleveland, Jan. 9, but no agreement was reached. The question is still under discussion.

UNIQUE HANDLING OF A FOUNDRY STRIKE.

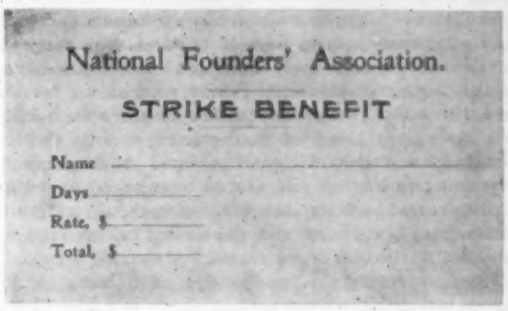
The Walworth Run Foundry Co. is one of eight concerns in Cleveland making a specialty of light gray iron castings. It is a member of the National Founders' Association, as are the other Cleveland foundries in its line of work A strike is now on at this company's plant that while not be distinguished by any violence or other demonstrations calculated to attract the attention of the public—being so quiet, in fact, that it has scarcely had mention in the city papers—is yet likely, on account of the novel procedure on the employers' part to attract attention far and wide.

The Walworth Run Foundry Co.'s works, like all other Cleveland foundries, has been operated as an "open shop." Union molders worked side by side with non-union men, though most of the employes belonged to local union No. 27 of the Iron Molders' Union. On Nov. 14, 1899, a committee of the men verbally notified the company that they desired to have the shop unionized and thereafter to employ none but union men. The company was given four days in which to answer. The men were asked to put their demand in writing but failed to do so. At the end of four days the company was asked for its answer. None was given, the men being told that if a formal written demand were submitted a like formal answer would be made. But without further ado 49 men went out. At this time it is understood that the national officers of the Iron Molders' Union had not sanctioned the strike, but that it was in the hands of local union No. 27. The company was informed in connection with the demand that unionizing the shop would involve the recognition of a shop committee of the men, who would require the company to post a labor price list of all patterns then in the shop, prices of any new patterns as they were brought in, to be submitted to this committee for approval. Grievances of employes were also to be submitted to this committee as arbiter between the company and individual employes.

After the men had gone out their cause was supported by their national organization, and the strikers were put on its strike benefit list to receive $7 a week each. The company called the attention of the men's leaders to the fact that it was a member of the National Founders' Association and that under the New York agreement between the molders' and the foundrymen's organizations the molders were to remain at work in case of any dissatisfaction and submit their grievance to arbitration. It was answered that the employes did not know when they struck that the company was a member of the National Founders' Association, and besides the strike was ordered by local union No. 27 and was not then in the hands of the national organization. The statement that the men were ignorant of the company's connection with the employing foundrymen's organization probably accounts for the selection of this foundry out of all foundries in Cleveland for the raising of the union issue.

The Walworth Run Foundry Co. submitted the strike to the National Founders' Association and a meeting of the district committee of which Jos. A. Stone, of Cleveland, is chairman, was held at once. It was decided unanimously to sustain the firm in its position and the conduct of the strike on the defense side passed into the hands of the district committee. The method adopted, it will be agreed, was unique. An effort was made to induce some of the striking employes to return to work and this in part was successful. The firm started with two or three men and gradually increased the number until today, including apprentices, there are between 25 and 30 men at work. Some of the men who went out, it was known, wanted to remain at work. In fact, the strikers' committee told the company that they had no fault to find with their wages or their treatment in other respects, the issue being solely that of a complete unionizing of the shop. Those of the former employes who were asked to return to work were offered, if they desired, a contract for steady employment for one year. They were told also that in addition to the regular rate of wages paid by the company at the time of the strike, every molder who went to work would receive a "strike benefit" of $1 a day, this coming as a bonus from the National Founders' Association. Thus those who went to work would receive, besides wages, the equivalent of the strike benefit which the strikers were getting from the Iron Molders' Union. In addition the molders were promised a card to be issued by the National Founders' Association, reciting that the holder had rendered faithful service under trying circumstances and was entitled to the consideration of all members of the N. F. A.

The strike is now on its eighth week, and though not working full, taking off a heat only every other day, the company is in other respects going on as usual and is turning out a good product. At every pay day since the strike began each employe has received in addition to his regular pay envelope, the National Founders' Association "strike benefit" in a specially printed envelope, of which a photographic reproduction is given herewith.


National Founders' Association.

STRIKE BENEFIT

Name _____

Days _____

Rate, $ _____

Total, $ _____

The argument of this method is one that will not be missed either by worker or striker. The worker is insured steady employment, besides extra compensation for staying at his post; and further, his course receives recognition, not only from his employer, but from the latter's associates in the employers' organization, and thus, if his work is satisfactory, he need never have any concern about securing employment.

It begins to appear, in connection with the Walworth Run Foundry Co. strike, that the Iron Molders' Union is convinced of the mistake made in the precipitation of the trouble. Its vice-president has sought to adjust matters by having all the men return to work, on condition that all workers who have been taken on since the strike, be discharged and then submit the original demand to arbitration. This proposition was not considered, since the company proposes to retain all competent men now working for it, and because of the further fact that the strike began with an indefensible violation of the New York agreement.

Standardized Iron Drillings.

To the Editor:

The American Foundrymen's Association committee on standardized drillings desires to report that there are now nearly 150 laboratories using its standards. As some of them use more of certain samples than of others, the committee, through your courtesy, desire to notify all who have purchased sets of three or four bottles, that they can now obtain separate bottles of samples A, B, C and D for $2 each. There are quite a few laboratories that have not yet adopted these standards, and those who are interested in bringing about a greater uniformity in analysis—which these standards are helping to do—will please address any member of the following committee:

Thos. D. West, chairman, Sharpsville, Pa.; Dr. R. Moldenke, Pennsylvania Malleable Co., Pittsburg; James Scott, Lucy Furnace, Pittsburg; P. W. Gates, Gates Iron Works, Chicago; E. H. Putnam, Moline Plow Co., Moline, Ill.

The American Steel & Wire Co. has assumed direct control of the Schoenberger Steel Co.'s properties. Formerly its control was through the ownership of the company's stock. In addition to the plants already mentioned as about to be concentrated on Neville Island, below Pittsburg, it is learned that there will also be moved thither one continuous rod mill from the Washburn & Moen plant at Worcester, Mass., the Cincinnati Barb Wire Co. plant at Cincinnati, O., and the wire mills at St. Louis, Mo. All the Pittsburg plants except the Rankin and Braddock works will be removed to Neville Island. Two Morgan and one Garrett rod mills will be built in addition.

LIMITATIONS OF TOOL-MAKING.

An article with the above sub-title, one of a series on "The Revolution in Machine Shop Practice," has been written by Henry Roland for the January *Engineering Magazine*. In the introductory portion Mr. Roland makes some observations on the general principles governing automatic operations:

"It has been clearly shown that if the human race continues to exist and to advance in morals, comfort, and elegance of living, tool-making must begin and must be carried to what now appears to be a high development. What is the limit of the tool-maker's art, and when and where should or must tool-making stop? Commercially speaking, it must stop in any particular case when more tool-making cannot cheapen the total time of cost of production; if the demand for the product is unlimited, then the only limitation in tool-making is the limit of human understanding and mechanical resources. When the tool-maker cannot further improve the quality or lower the cost of the product, then, very clearly, the end of his usefulness in the particular has come. If the demand for the product is limited, and cannot be enlarged by bettering the product and reducing its selling price, then there is a total remuneration to consider, and the limited total remuneration must limit production expenditures, tool-making included.

"Broadly speaking, it is conceivable that in some special production tool making may be carried to a point where no farther profitable advance can be made, and it is also conceivable that there may be things useful and desirable to the few, which cannot by improvement of quality and lowering of cost be made useful and desirable to the many; but it is extremely difficult to select examples illustrating either of these propositions. Speaking narrowly from existing facts and conditions, it seems probable that the limit of tool-making has never been reached in any particular case.

"Suppose an article to be produced wholly by automatic machines, so that its cost does not include any direct labor. It was Spencer's custom, when he first set a few of his double automatic screw machines at work making screws from large coils of wire, to lock up the room and go away and leave the machines wholly unattended for a considerable period of time, perhaps almost as long as the stock would last, and it was the rule for him to find all of the machines still at work when he again unlocked his factory door. Here is an autual case where labor cost was wholly eliminated, but this does not stop tool-making in that direction. No automatic toll is so good that it may not be bettered, and a machine which seems a miracle of perfection to a casual observer may be well known by its builder to be susceptible of great improvements. All cases of tool-making seem to fall into the common conclusion that, since perfection is beyond finite powers, tool-making can never end even in one particular case.

'In practice, tool-making does end, as a rule, when the production cost is lowered below that of competing makers; but if the competitor improves his tools and lowers the previous lowest production cost, then other must do more tool-making or fall behind the trade. In the case of unlimited demand and open competition in production, which is the general case of manufactures at large, tool-making may be carried to any extent."

The article goes at length, and with plentiful illustration, into the remarkable achievements of Duane H. Church, in developing new capabilities of automatic machinery at the American Waltham watch factory. It is shown that he advanced the use of Maudslay's slide rest and Stone's turret to the highest point of development yet attained and "gave those elements powers which appear impossible of farther advancement. The Church machines in all cases complete the piece produced, before letting it go. Church added to the slide rest and turret two new elements—first, that of compressed-air-driven piston-and-cylinder actuation of his automatic-machine members, and, second, a perfectly exact series of transfer elements, having the power to take a piece of work from one machine and place it accurately in another machine, with a beauty of action and precision of effect which seem to the experienced observer, when he sees these automatic machines in operation for the first time, to fall very little short of miraculous. In addition to the pneumatic and transfer elements, Church originated an automatic grinding machine, which produces cylinders and cones with absolutely no measurable variation in dimensions, wholly without human intervention, and at a saving of at least three-quarters of the cost of producing ground work under manual attendance." There was developed, as the article describes, a complete scheme of watch-plate drilling, the plates being supplied in filled delivery magazines to the drilling machines and by means of transfer arms and hands passed from machine to machine until the 160 different operations on a full plate are performed. In conclusion the article says:

"Here, then, we have the highest known development of the possibilities of the tool-maker's art, due to the addition, by Church, of compressed-air actuating devices to Maudslay's slides and Stone's turret. The compressed-air movement makes accuracy possible, as it never before was. Compressed air gives movements with any degree of force, within any space limitations imposed by the exigencies of tool construction, and—impossibility of impossibilities—without wear. The largest plate-drilling machines have a delivering and receiving magazine, six plate holders, six spindle heads carrying six spindles each, making 36 live spindles in all, and seven transfer arms and hands.

"Within certain size limits, this compressed-air actuation n combination with these transfer elements, which are capable of taking a piece of work of any form and accurately locating it in a work holder of any description, show the road to completely finishing any metal piece without direct manual intervention. That is to say, the methods and means now in operation at Waltham can be so modified as to produce any machine part without direct labor. As to diameter limit of work produced by this system, Church said that he thought his devices might be successfully and economically applied to pieces up to 10-inch or 12-inch diameter, and, in many forms of pieces, the length would be no bar to automatic finishing."

Will the Coke Supply be Sufficient?

The Connellsville *Courier* points out that the coke production for 1900 is an important element in calculations concerning the output of pig iron: "It was pointed out in this review a week ago that the report that was going the rounds of the press stating the furnacemen were holding off for cheaper rates because of the building of so many ovens that the price would be lowered, was false, and this conviction has now dawned upon many. There is an impression growing that the ore production for the coming year will reach 20,000,000 tons. It will not matter what it reaches, because only so much iron ore can be smelted as there is coke to smelt. The fuel question has been overlooked. The number of new ovens is comparatively small. The three new plants in Southern Fayette county will not be completed before next September, and will do little toward relieving the coke famine for 1900. The table shows 19,689 coke ovens, and before the close of next year the total number in the Connellsville region will not be much more than 20,000. If 21,000 ovens can be operated for the year full time, the total production will not reach much beyond 11,500,000 tons, so that furnacement can gauge the situation with that amount of coke not far from the limit on which to base their calculations."

ROUSE & BRAUN, engineers and machinists, whose shops are at Western and Grant aves., Allegheny, Pa., are manufacturers of sheet metal tools and dies of all descriptions, including blanking, combination, forming, drawing and drop forging dies. Both are experienced in the practical operation of their business. Mr. Rouse is a native of Scotland and had a number of years experience there in the manufacture of dies. Mr. Braun secured his experience in Pittsburg, where he was identified for a number of years with the drawing and stamping business. The firm also does general repairing work.

The Chicago office of Wickes Bros., Saginaw, Mich., recently took a contract for five 200 h. p. vertical water tube boilers for the new rolling mills of the Inland Steel Co., which are to be located in the vicinity of Tonawanda, N. Y.

NEEDS OF ENGLISH IRON WORKS.*

BY HARRY B. TOY.

[In his introduction the writer of the paper suggests that American and other competition calls for effort to improve iron and steel manufacturing plants in the Midland counties of England. "It is not my intention to recommend all iron works proprietors to dismantle their existing plants and replace them with something quite different; but to make the necessary modifications to those details which seriously affect the cost of production, and which in many cases may be done at a small expense."]

Shee Iron Mills.—Whether steel sheets are likely to entirely replace iron sheets for roofing purposes seems very questionable, as there are very many details in favor of iron galvanized sheets, and Staffordshire being an iron-producing center, it is to be hoped that strenuous efforts will be made to improve upon the plants at present employed in the manufacture of same. It is to me deplorable that by force of circumstances, or otherwise, manufacturers continue to consecrate the whole responsibility of driving helves, forge trains, shears, finishing mills, pumps, etc., with a single engine, and I am sorry to see at the present time old worn-out egg-ended cylindrical boilers being replaced with new ones of precisely the same design, when at the same time the men working in the mills are constantly having to wait for increased pressure of steam before they can proceed with the rolling. During the last few months I have had occasion to indicate several sheet mill engines, and to my astonishment there was not a single instance where the vacuum in the cylinder was more than 9 lbs. per square inch, and in one or two cases not more than 4 lbs., whilst the vacuum gauge affixed to the condensers registered a steady vacuum of nearly 14 lbs. in nearly every instance. I am sorry to state that at some of these works steam was being generated by hand firing. My contention is, that so long as managers content themselves with the mere reading of a gauge as to whether the engine is working satisfactorily or otherwise, they need not be surprised at the disastrous result which will follow in times not quite so favorable as the present. I very strongly recommend a periodical indication being taken of the amount of work actually being done in the cylinder, as I am sure that from this course a saving in cost of production may reasonably be expected. I should very much like to see a sheet iron works erected in South Staffordshire upon strictly modern lines, such as puddling furnaces in a line similar to those described in my remarks upon the guide mill plant, with a good steam hammer, quick-running forge train driven by an independent condensing engine, with heavy flywheel; also, four single sheet mills, with chilled rolls 24 inches diameter, driven by two condensing engines, each capable of developing about 350 indicated horse-power, running at about 50 revolutons per minute, with a flywheel about 30 feet diameter, 40 tons weight, fixed on the engine shaft, and a pair of massively designed helical teeth wheels supplied to reduce the speed of mill shaft to 38 revolutions per minute. The bar-sheet and scrap shears, each self-contained, and redriven by separate engines. In my opinion the cost of producing iron sheets with the above plant would compare even more favorably with steel than at present, especially when steel sheet bar makers are more profitably engaged in producing other sections. There is just another consideration which I think worthy of attention—viz., whether it be possible to design the forge and bar rolls to do more of the work necessary in making good iron sheets, by way of increasing the width of bar at present used, and thus reducing the amount of work usually done in the chilled rolls. In the question of output, iron sheet makers have made great progress during the last few years, as there are many of them now rolling over five tons per turn of 12 hours of mixed singles, doubles and lattens in a single mill.

Steel Sheet Mills.—If steel sheets are to be manufactured profitably in the midlands, it will only be done by the introduction of some enterprising capitalists of a modern steelworks for the conversion of our local pig iron into steel, such as the Siemens or Bessemer basic process, as the railway carriage upon steel sheet bars imported from other districts in some instances, is as high as 17s. 6d. per ton, and it cannot be reasonably expected that our local steelmakers will employ their mills in rolling cheap sheet bars, when they can obtain orders up to the full capacity of their mills for more profitable sections, and for which their plant is better adapted. There are several attempts being made in Staffordshire to roll steel sheets in old iron mills, but considering the many difficulties in this departure, I am afraid the trials will not be attended with very great success. The ultimate monopoly in the steel sheet trade, in my opinion, will be vested in those who have their own blast furnaces, steel smelting works, and sheet works, in which case I hope the circumstances may be sufficiently favorable to influence the first plant in this neighborhood. The plan I most favor for steel sheets is a pair of compound condensing engines, about 1,000 indicated horse-power, running at a speed of 50 revolutions per minute with a heavy flywheel fixed on engine shaft, and a pair of strong wheels, as previously described. I should place two mills on each side of this engine, with chilled rolls 24 inches diameter, and at the end of each second mill I should provide a friction wheel arrangement, by which to avoid "back lash" and keep all the couplings in regular torsion. The housings of steel sheet mills must necessarily be massively designed, as the steel bars are rolled into sheets at a much lower temperature than iron, and the material will allow a more rapid reduction in thickness. My choice of mill bed-plate depends entirely upon circumstances. The American or girder section is very convenient for the removal of broken or worn-out rolls; but there is a danger that one piece of this bed-plate may subside without the other, in which case the expensive machined surfaces would not be of any value. The advantages claimed by some engineers of the ordinary dovetailed bed-plate are, first, that the wooden blocking securing the housings affords an amount of elasticity which is not obtained in the American design, and which is considered to be of great value in obviating breakages. This idea is confirmed by the adoption of wooden keys and sleepers upon our railways. Secondly, that where there is a difficulty in obtaining a good foundation, there is an advantage in the dovetailed bed-plate, as the whole weight of the mill is distributed evenly over a greater surface of the foundation. My impression is, that in the near future, steel sheet bars 18 inches wide will be rolled direct from the ingot, in a Universal reversing two-high mill; in fact, a friend of mine abroad is at the present time contemplating doing so in an experimental way. To drive this plant I should provide water-tube boilers, working up to a steam pressure of 160 lbs. to the square inch. The bar heating and open annealing furnaces may be coal-fired, and the close annealing plant could be conveniently arranged to be heated by producer gas.

Steel Section Mills.—The experts differ very much in their ideas as to the best arrangement of mills and furnaces for the production of steel sections. Some prefer to charge their ingots into radial gas furnaces by means of a hydraulic charging and drawing machine, then transferring the heated ingots to the cogging mill, where they are reduced into blooms, cut to lengths and reheated in other gas furnaces before rolling in the finishing mill. Others prefer, instead of using regenerative furnaces, to utilize the waste heat in generating steam; but it appears to me that the most modern method adopted is to take the ingots from the casting pit, charge them into underground gas-soakingpits, then directly from these heated ingots the sections are finished without intermediate heating, but obviously this can only be accomplished by increased speeds of mill engines, live roller gear, etc. The most recent plant I have seen on these lines consists of soaking pits in a parallel line with the steel smelting furnaces, the lids of which are removed by a neatly-designed machine, actuated by hydraulic power. The ingots are removed from the casting pit by hydraulic cranes and charged into the soakers, two ingots in each hole. One skilled man and two youths represent all the labor employed at these soaking pits. The heated ingots are drawn and inclined into a simple form of tilter, which lowers the ingot on to rapidly-driven live rollers, and conveyed to the cogging rolls, which are 34 inch centers and driven by a pair of high-pressure engines, with cylinders 46 inches diameter, 4 feet 6 inches stroke, and speed wheels. After cogging, the formed bloom is transferred to a vertical shearing machine capable of cutting hot blooms up to

*Extracts from a paper read before the South Staffordshire Iron and Steel Institute, December 16, 1899.

30 inches wide by 12 inches thick, the ends being cropped off by these shears; the bloom is very rapidly conveyed on live rollers to the roughing rolls of a finishing mill, about 30 inch centers, which is driven by a pair of direct acting engines, with cylinders 54 inches diameter by 5 feet stroke, running at a speed of 90 revolutions per minute, being equal to a piston speed of 900 feet per minute. The finished section being rolled in this mill, upon my visit, was girder 14 inches by 6 inches by 100 feet long. The cogging rolls were designed with forming holes, being preferred to lifting and lowering the top roughing rolls with screwing engines, as the draught is considered to be more definite and the breakage of roughing rolls less liable. The average output of this section in one turn of twelves hours is about 160 tons. Angles, too, are produced direct from the ingot without any other than a wash heat in the soaking pits, and I have seen a steel angle 3 inches by 3 inches by 5/16 inch rolled direct from the ingot into one length of 475 ft. The angle was leaving the rolls at the rate of 700 feet per minute. It is, of course, needless for me to say that this was only done experimentally, and is not likely to be successful from a commercial point of view, as the wear in the finishing groove renders the section too rough for particular purposes, and there is a variation in the actual section from one end to the other. This method of direct rolling is, of course, attended with enormous consumption of fuel to generate the necessary steam, but to economize in this direction, water-tube boilers are being used, also compound reversing engines, which, although condemned as unsuitable years ago, are, by the introduction of separate condensing plants, now being used satisfactorily. I believe that we shall, within the next few years, further reduce the cost of running these large section mills by the adoption of a good reliable friction clutch in connection with compound condensing engines and reversing gear, and if only the present users had erred more on the side of being over rather than under the power required, the doubt as to their adaptability for this purpose would have been removed ere this.

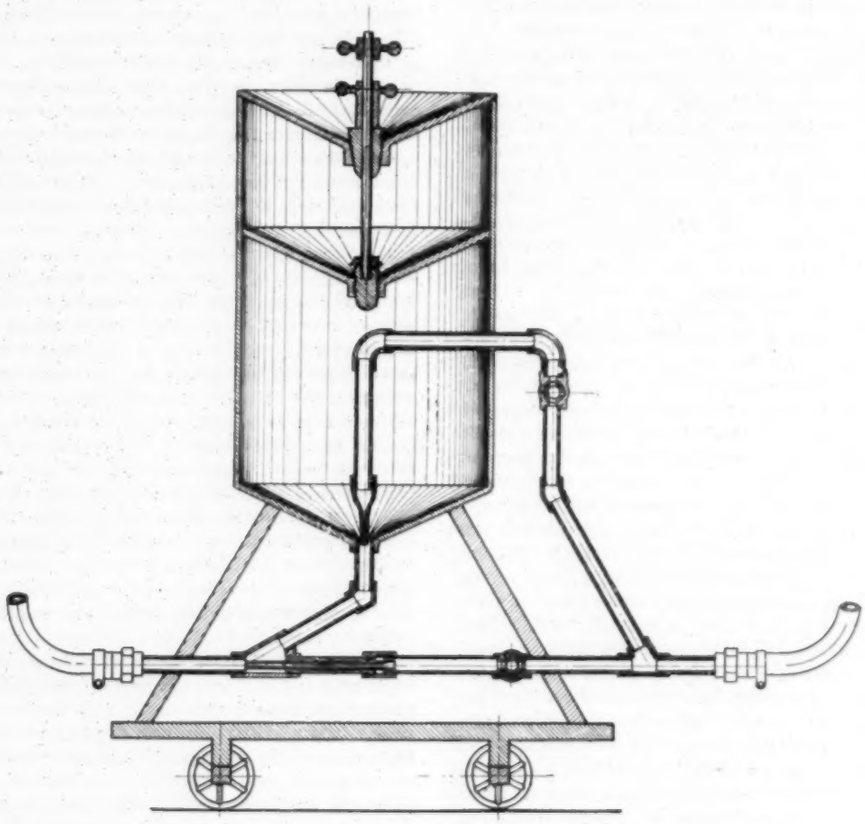
The Ohio works of the National Steel Co. will have a capacity of about 2,200 tons a day. The completion of the rail finishing department and of the continuous mill for small billets calls for increased converting capacity. More blowing power will be supplied and two new spiegel cupolas will be erected. Two addtional craes will be installed.

NEWHOUSE SAND BLAST.

As is well known, there is an increasing use of the sand blast for the cleaning of metal surfaces, preparatory to painting, enameling, plating, nickeling, etc. A machine that has been in successful use for some time is shown in section in the accompanying cut. It is the invention of J. M. Newhouse, of Marble Cliff, O., and a patent was granted on Nov. 7, 1899. Since it was first put into use the apparatus has been improved, so that the reservoir, which is made portable by mounting on a truck, as shown, can be filled with sand without any interruption of the work. The cut shows the manner of admitting the air blast and the arrangement for feeding the sand from the reservoir. The result of a recent test, as given by the inventor are as follows, and show the efficiency of the apparatus under the conditions stated below:

Surface cleaned,	226.6 sq. ft.
Free air used,	10,200 cu. ft.
Sand used,	3.14 cu. ft.
Air pressure at machine	35 pounds.
Cost of air per hour,	33.8 cents.

This test was made on the iron work of a viaduct at the approach to the Columbus, O., union depot, where the iron work is subject to heavy corrosion from the sulphur and other elements in the smoke, and the moisture from the exhaust steam of locomotives.



THE NEWHOUSE SAND BLAST.

Among the latest orders booked by the United Boiler Co., of Girard, O., are three self-supporting stacks 80 feet high for the National Tube Co., Youngstown, O. It also has a contract for one new 18x85-foot stove and the alteration of present stoves for Hannah furnace, of the Republic Iron & Steel Co., Youngstown, O. On account of the pressure of work the boiler company contemplates extensive improvements in its plant.

The Standard Foundry Co., which purchased sometime ago the then idle foundry of the American Foundry Co., Cleveland, will operate it to full capacity the coming year, thus largely increasing its output.

RECENT TESTIMONY ON SANDLESS PIG IRON.

An article by Thos. D. West in a late issue of the *American Machinist*, besides covering some ground with which our readers are familiar, gives some data that represent recent experience and testimony relative to the use of pig iron cast in molds. From the latter portions we make some extracts below. Special interest attaches to the statements of foundrymen who have made test of sandless iron in their mixtures:

Among the advantages so far found, "sandless pig" may be said to offer the following: First, in being an iron which melts faster; second, in affording the softest remelts; third, in requiring less flux to make a good slag; fourth, in giving a cleaner iron; fifth, requiring less fuel; sixth, in giving an iron which loses as little if not less than sand pig by oxidation. To these can be added the seventh, which may be termed a greater uniformity of the metalloids, caused by the liquid iron at the furnace being caught in a ladle before being poured into the pig molds, which act as a mixer. The importance of this factor will be understood when we stop to realize what it means to find one end of a cast of pig iron run into sand molds after the old fashion, to be one per cent higher in silicon than the other, something which is liable to happen at any time in operationg a blast furnace. The two ends of a "cast" poured from a ladle would be very closely alike in their silicon, etc., contents; so that if in shipping iron each ladle's pouring was kept by itself, after the manner each furnace "cast" is generally piled or shipped, foundrymen would find a much greater uniformity in the grade of iron coming from their cupolas than is generally done by using pigs cast in sand beds.

It has been claimed that the fracture of sandless pig can be accepted as a true guide to judge its grade, or what per centages of silicon and sulphur a "cast" or piece of pig metal may contain. To what extent this is true I am not now prepared to say. However, there is this much that can be said: A "cast" poured from a ladle is bound to be more uniform in its grain than one run in sand pigs. It is also to be understood that because "sandless pig" is sometimes called "chilled pig," it does not follow that the sandless pig is always really chilled or shows any white fracture. This may be so with iron very low in silicon or high in sulphur. With iron above 1 per cent in silicon and not having over .04 in sulphur, we may, as a rule, expect the outer body of the sandless pigs or that lining the iron mold to be little affected by chill, so that with sandless pigs suitable for making gray castings, their fracture would look gray throughout the body, with little or no indications of having any "chill."

One drawback which may be said to exist in the adoption of sandless pig consists in the present form of pig molds, giving a pig that is rather clumsy for foundrymen to handle. If inventors of casting tables or furnacemen seeking foundry trade, would try to make their sandless pigs of a size corresponding to the sand pigs foundrymen have been accustomed to use, I believe there is not one but would be glad to give sandless pig a trial, and ever after be desirous to continue its use.

I am pleased to say that information has come to me since mailing this article, that one of the manufacturers of casting tables has experiments now being made with molds to give a pig about 75 pounds in weight, to take the place of the larger pig now being used, and which is so objectionable to founders.

Knowing that Mr. Edgar S Cook, the well-known blast furnace expert and president of the Warwick Iron Co., Pottstown, Pa., had experimented in making sandless pig to have founders test it before he would place casting tables in his blast furnace, I wrote him asking for his experience, and received a reply, from which the following extracts are made:

"We have not yet adopted a casting table, but we propose doing so, and will doubtless have one in operation some time next year. A few months ago, we ran a lot of foundry iron into cast iron molds such as are used in the manufacture of basic iron. This iron was selected by analysis and sample carloads furnished to our various customers, care being taken that the sandless pig should be of practically the same silicon and sulphur contents as the sand pig that we had been accustomed to send them. In regard to the composition of sandless pig, so far as silicon and sulphur are concerned, there is no reason why the sandless, after a little experience, cannot be judged far more accurately by fracture, as to the composition, than is the case with iron cast in sand. Of course, the ability to make a fairly good guess will be dependent upon the experience of the observer and after comparing the fracture of the sandless pig with many analyses. I enclose herewith copies of letters from parties, which speak for themselves."

From the letters Mr. Cook sends, the writer takes the following extracts:

From a prominent tool-building concern: "We have tried the sandless iron and find it very nice. You may ship more on our orders."

From a stove foundry: "From the experience we have had we believe, thus far, that you can be sure that there is one foundryman who does not fear the sandless pig."

From the foundry superintendent of a large ship and engine building establishment: "I am pleased to say that your sandless pig is very satisfactory. I hope hereafter that you will always ship me sandless pig. It saves a good bit of trouble in the cupola. I think you are making a move in the right direction."

From Girard Iron Works: "We are using the sandless pig iron and have had, so far, very good results from it."

From Lebanon Stove Works: "We have watched the results very carefully thus far and find it very satisfactory. The only objection we have to the sandless iron is that the pigs are too heavy and hard to break. Our cupola men can hardly handle them, as our facilities are such that the short, heavy pigs of the sandless iron cannot be broken; otherwise, we are very much pleased with it."

Strength of Steel Balls.

The results of tests made at the Rose Polytechnic Institute upon steel balls were reported by J. F. W. Harris at the New York meeting of the American Society of Mechanical Engineers. Balls were procured of sizes ranging from ½ to 1 inch in diameter from six manufacturers, and the attempt was at first made to test the balls by crushing between hardened steel plates. Difficulty was experienced, however, in procuring steel so hard that it would not indent under the pressure to which it was subjected in contact with the balls, and the plan was adopted of placing three balls in a row in a special holder, which kept them in line axially. Pressure was then brought to bear upon the two outer balls, eventually crushing the middle one. After this series of tests was completed, a steel was found that answered the purpose for testing the balls between flat surfaces and another line of tests was conducted with the balls between two flat plates of this steel. A singlar fact is that in the first series nearly all the balls were broken by the formation within the ball of a conical wedge which was gradually forced toward the center of the ball until the latter was split. The base of the cone was approximately circular, with its center at the point at which the crushing force acted. The following table gives average results of the two series of tests. It will be seen that the values in the last horizontal row are higher than in the second row, showing that the balls withstood more when tested between flat plates than when they had the point contact, simply, of the first test:

Diameters.	Breaking Pressure in Pounds. Strength.					
	½	⅝	¾	⅞	1	1
Between two balls . . .	2,000	4,000	8,000	15,000	22,000	60,000
Between flat plates . . .	2,000	5,000	12,000	20,000	32,000	90,000

The harbor which is to be built at the terminus on Ofoten Fiord, Norway, of the railroad from the Gellivara iron mines in Sweden, will be about 120 miles north of the arctic circle. The ore docks to be built there will be patterned after those of Lake Superior, experts having traveled through the Lake Superior region inspecting the ore-loading equipment at the various docks. Arrangements will be made for the loading of ore at the rate of 1,000 tons an hour.

The Republic Iron & Steel Co. has appointed Rogers, Brown & Co exclusive agents for the sale of the product of its Pioneer, Ala., furnaces, excepting for New York City and vicinity. The Pioneer brand is well known throughout the country and has a good record for quality and uniformity of grading. It is called for by consumers desiring a strong Southern coke iron.

LIDGERWOOD CABLEWAYS.

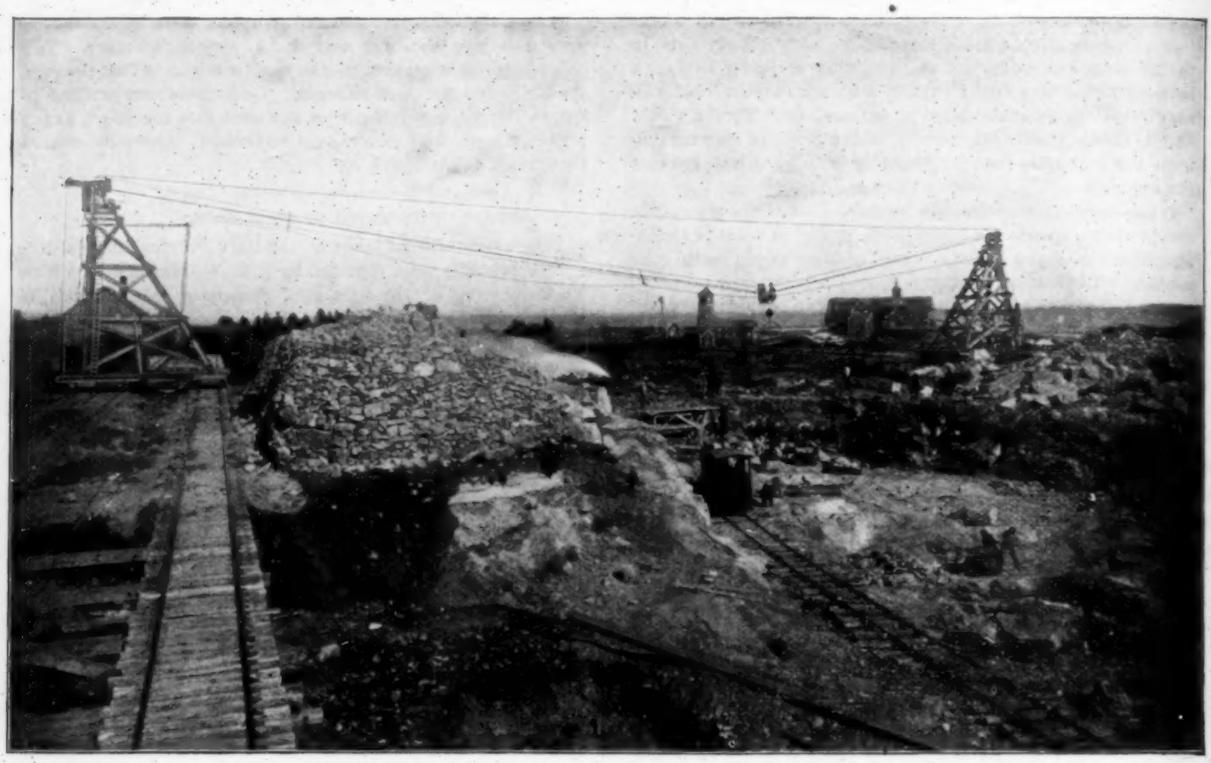
The Lidgerwood cableway is especially adapted for dam and bridge building, open pit mining, quarrying, sewer and canal excavating, construction work, and for contractors' purposes in hoisting and conveying material of all kinds. It is particularly fitted for operation in a horizontal position, but may be inclined to suit local conditions. The main cable is of crucible or cast steel wire and is suspended from towers, or "A" frames, with the ends securely anchored. The span or distance between towers ranges as high as 1,600 feet. This cable serves as a trackway upon which a traveling carriage moves and connected with which is a fall block for raising and sustaining the load.

Three moving ropes are employed in this style of cableway —one for conveying the carriage along the main cable, and called the traversing or endless rope; another, which is connected with the fall-block, and used for hoisting the load, called the hoisting or fall-rope; a third, or button rope, is used for displacing the fall-rope carriers from the carriage at regular intervals along the cable. The power for operating the cableway consists of a Lidgerwood hoisting engine of special design, having double cylinders, reversible link motion, and double patent friction drums and brakes. Both drums are of the same diameter, and are placed either tandem or side by side. One of these drums is grooved and carries the hoisting rope, the other is generally turned smooth and of curved form to receive the traversing or endless rope.

The traversing or endless rope is attached to each side of the carriage — on one side passing to the outer tower, or "A" frame, and back to the inner tower where the engine is located, making half a dozen turns around the curved drum on the engine (or enough to secure friction) and thence back to the carriage, which serves as a link to secure the two ends, making it practically an endless rope; this rope is supported at the towers by suitable sheave wheels. It will therefore be seen that as the engine is reversible, by turning this endless rope in either direction the carriage is pulled along the cable either way, as desired. The hoisting rope passes from its drum on the engine to the carriage and there connects with the fall-block, usually by a two or three-part purchase.

The hoisting rope is supported by a system of fall-rope carriers, upon which the successful operation of the whole cableway depends. These carriers are of simple form with small wheels for supporting the ropes and are carried on a horn on one end of the carriage. By means of this cableway materials can be hoisted at any point on the cable and conveyed to any other point and lowered without any loss of time and without the use of any shifting locks or catches to get out of order or break. The fall-block can also be lowered by its own weight at any point on the cable. Any kind of material in loads up to twelve or fifteen tons can be handled either by skips or buckets, or in the case of heavy stones, by chains or hooks. The entire operation is under the absolute control of the engine driver.

An important feature of the Lidgerwood cableways is the patent aerial dump which permits of the load being dumped automatically in mid-air, while the carriage is in motion and without the employment of a man on the dump pile. The aerial dump is operated at the will of the engine driver by a simple arrangement of ropes and catches and its use insures a very large increase in the capacity of the cableway. The half-tone shows a Lidgerwood traveling cableway with a span of 315 feet, designed for loads of four tons and used for handling excavated rock and placing concrete, etc., on work at Gerrish Island, Portsmouth Harbor, Me., in charge of the U. S. Corps of Engineers. The Lidgerwood Mfg. Co., 96 Liberty st., New York, manufactures the cableway under 21 patents.



LIDGERWOOD CABLEWAYS AS EMPLOYED IN EXCAVATION.

THE turning of electric power from Niagara into the malleable plant of the Pratt & Letchworth Co. at Buffalo, for the driving of all its equipment, was made a noteworthy occasion on Dec. 30. Nearly 100 Buffalo business men and a few outside guests were taken to the works in special cars and were shown through the various departments. About 20 acres of ground is occupied, 12 acres being under roof. At noon the current was turned into the big rotary converter which is belted to the main shaft. The current of 2,200 volts is transformed to an alternating current of 168 volts, which again is transformed to a direct current, and this is distributed to small motors, few or many of which are operated at once as desired. Luncheon was served to the guests and some speeches were made. Mr. O. P. Letchworth presided, and among those who responded was Wm. A. Rogers, of the Tonawanda Iron & Steel Co. On New Year's day the company entertained its 1,300 employes and their wives and other friends, 2,000 in all. Luncheon was served and there was band music and a program of dancing in the company's great warehouse, this having been handsomely decorated.

AMERICAN CRUCIBLE STEEL INDUSTRY.*

How Competition with England Has Developed.

BY WILLIAM METCALF, OF PITTSBURG.

Some time ago I was invited by you to say why, in my opinion, Americans can compete with English manufacturers, and to state in what way American methods are more economical, and how much their raw materials are cheaper than the English. I do not feel able to answer such questions directly, and can think of no better way to interest your readers than to give a history of a crucible-steel concern, and to leave it to them to draw their own conclusions. In 1865 three young men, a Sheffield lad, a hammerman by trade, a mechanical engineer, and a business man, the latter two Americans, built 12 melting holes and three steam hammers; in January, 1868, they were joined by another young engineer, and 12 melting holes and one 12-inch train rolls were added to the plant. The total invested capital was $100,000.

About 1870 the Siemens regenerative furnace was introduced into Pittsburg, and shortly after these young men tried one and found it efficient and economical. In less than three years they added more furnaces, until they had invested in furnaces and royalties $50,000, without adding anything to the capacity of the plant except the equivalent of 12 melting holes. In about five years the saving in fuel wiped out the $50,000, so that the change had then cost nothing. There was an enormous gain in the efficiency and in the behavior of the men, that could not be figured in money; it was a great advantage, however, and it continues to this day. It was soon found that the best American iron of that day would not quite make as good steel as the best Sheffield brands; then one of the young men went over to Sweden, only to be told that it was impossible to buy a pound of the best Dannemora iron. The Sheffield steel men had bought it all for five years, with an option on the next five years, the owners being bound by strict contracts not to make any more iron nor to sell any ore. After a thorough visit to the mines and forges, our Yankee went back to Stockholm and told his iron merchant that the chain seemed to be complete, but that there was a link loose, and he wanted them to find it. There were many owners of the mines, and one obscure owner with a disused forge had a right to some of that ore, and he wanted them to find that man, and get him to make them some iron.

At first he was laughed at heartily, and then promised that a search should be made for his mythical man and forge. Within a month of his return home word came that the man with a forge had been found, and that for a three-years' contract he would furnish an iron guaranteed to be equal to the famous double-bullet hoops L or other highest-class brands. The contract was made. At the end of three years it was continued, and the quantity was increased. At the end of the second three years, all of the great Dannemora brands, with perhaps one exception, were for sale in the open market.

Our young Yankee found the steel works of Sheffield as hermetically sealed as the Dannemora business, the holders of the keys being apparently unconscious that their most expert workmen were swarming over to the States, and that many of them were offering for sale copies of their mixtures for all of their brands. Our young men did not buy the mixtures; they bought the iron and employed the men. In 1876, Dr. C. W. Siemens visited our Yankee in Pittsburg and examined his plant; he noticed some nice clean nut coal on the producers and asked its cost. Seventy-five cents, or three shillings, a ton, astonished him. He next asked the quality and price of some iron he saw, and was told that it was about equal in quality to the ordinary grades of Swedish melting iron and cost about nine pounds a ton where it lay. Then he asked, "What do you want of a tariff when you have such splendid cheap fuel and good cheap iron?" He was told that it was for defense, and out of pure benevolence and love for our British cousins; for defense, because the cheapest and best standing army was a nation of well-paid and contented citizens; for benevolence, because if the tariff were removed and our men were brought to the level of Sheffield wages, Sheffield would starve, and we did not want to starve our relatives. At the close of his visit Dr. Siemens placed his hand on our Yankee's shoulder. A strange and rather sad expression was on his face, and he said, "My young friend, I have been very much interested to-day. It pains me far more than I can tell you to have to come more than 3,000 miles from my home to find the best application of principles that I have spent my whole life in developing. Your plant is fifty years ahead of anything in Sheffield."

In regard to the workmen, it is safe to say that a more hidebound set of men never left England. "You mustn't do this;" and "you cannot do that;" "this is impossible," and "such a thing as that was never heard of," etc. After ten years or so you might ask the most stubborn of them to do the most apparently impossible thing, and the answer would come, "I'll try it." Why? It must be in the air. In regard to iron, the best Dannemora still maintains its pre-eminence for some special purposes, but the great bulk of American steel is now made of American iron only slightly, if at all, inferior to the Dannemora, and costing less than one-third as much. In the sixties, axe steel and fine edge tool steel cost about 16 cents a pound, in the nineties, axe steel sold for 4 cents a pound, and the axe makers say the steel is good, and that they are inspecting and testing their tools more rigorously than ever before. It is proper to say that the concern referred to is now prominent, successful, and wealthy.

Thirty years of experience with him in this country leads one to the conclusion that John Bull is a thoroughly good fellow—strong, active, and ambitious, and obliging when he is taken in the right way. He is generally prosperous and well-to-do, and owns his own home or builds up a business for himself when he uses his ale sparingly. Ale and the climate of America do not appear to agree, and when the disagreement is reinforced by hard liquor, disaster follows.

As to the engineering ability, skill, scientific knowledge, and patient and careful research, English engineers are certainly in the front rank in skill and knowledge, and well in the lead in careful and patient research. If we Yankees are in too much of a hurry to give time to patient research, we take time to read your technical journals, and sometimes we profit by them. In regard to Nature's gifts, we are all familiar with her exceptional bounty to England, but it seems as if the world had hardly begun to realize the remarkable richness of the great Appalachian region of the United States.

From well up in New York, extending in a southwesterly direction through Pennsylvania, the Virginias, North Carolina, Kentucky, Tennessee, and far into Georgia and Alabama, is a mountain region abounding in coal, iron, and other minerals. There is scarcely an arid acre in the whole region, and the climate is healthful and invigorating. This country is flanked on all sides by some of the richest agricultural districts in the world. It is traversed by numerous large rivers, the navigable distances from Pittsburg being given at about 15,000 miles. Coal is as the dirt in the hills; it is estimated that in Western Pennsylvania alone, above the water levels, and leaving out all veins less than three feet thick, there has been enough good coal located by the State Geological Survey to supply all of the demands of this continent for 500 years. Add to this the great known deposits below the water levels, the States of West Virginia, Maryland, Kentucky, Tennessee, and large parts of Alabama and Georgia, and you have a coal area where you might hide the whole British coal district several times over.

If there is another spot of earth of such size and great natural wealth as this Appalachian region, man has not discovered it, or if he has, he has not made it known. This then is enough in considering the probabilities of the future; your readers are already well informed as to how much more there is in our country. You know of our annual output of millions upon millions of tons of coal, iron, steel, glass, etc., and yet the greater part of our Appalachians is virgin territory; where you may hunt the wild turkey and deer in immense forests of fine timber, where the speckled trout abounds in the streams, and where the natives still find corn pone, and hog and hominy, sufficient for their wants—a diet not to be despised after a day's tramp in the woods.

In the near future the competition between us will be keen, sharp, and vigorous; let us conduct it as fairly and in as manly a way as our cup challengers and defenders have done recently. In the far future, when you have practically exhausted nature's bounties, there will be room over here for all of your workers, and over there a lovely resting place for the worn and weary. In the meantime, as between ourselves, "Let us have peace."

* From London Engineering.

A PIONEER PLANT IN THE WIRE TRADE.

Mention was made last week of the retirement of W. J. Hayes, for 30 years manager of the wire departments of the Cleveland Rolling Mill Co., Cleveland. The employes in these departments, in testimony of their esteem for Mr. Hayes, made his withdrawal the occasion of a gathering together of all the day force in the wire works on Saturday, Jan. 6, at the noon hour. Mr. Hayes was summoned to the meeting and was presented with a magnificent loving cup and a leather easy chair, the address being made on behalf of the men by John Skyrm, foreman for the past thirty years under Mr. Hayes. The response brought to the surface the feeling which only one could appreciate who had been so long connected with works management, and had had all the time such loyal support and co-operation as Mr. Hayes acknowledged in his words of farewell. He put strong emphasis on the statement that only by the earnest service the men had rendered was success made possible. After Mr. Hayes had spoken Mr. Garrett, inventor of the Garrett rod mill, who had been connected with the Cleveland Rolling Mill plant in the earlier portion of Mr. Hayes's administration, referred to the wonderful development of the wire industry in the West, from its small beginnings in Cleveland. He paid a high tribute to Mr. Hayes's insight and courage and to the ability he had shown in management and in improvement of practice. He named F. H. Daniels, C. H. Morgan and W. J. Hayes as men who had been leaders in the development of the wire industry on its mechanical side. By way of reminiscence Mr. Garrett spoke as follows concerning the Cleveland Rolling Mill Co.'s operations:

"The wire mill of the Cleveland Rolling Mill Co., under the leadership of W. J. Hayes, has always been a successful institution. During the panics that we have passed through since 1868, this wire mill has always run steadily, and financially on the right side of the ledger, and with this did not pay the lowest wages. Mr. Hayes, with the assistance of Mr. Augustus Brockman, cast aside all the ancient traditions connected with wire drawing, and led a pace in innovations, that others had to follow. For years, this was not only the first, but the only mill that made wire from Bessemer steel which was from .25 to .35 in carbon, or suitable for steel rails. For years the base of supply for this wire mill was the crop ends of Bessemer steel rails, which were first rolled into billets and then into No. 4 wire rods. This material furnished fence wire, market wire, spring wire, binding wire, and in fact the finest and the best grades of wire—all from old steel rail crop ends—the different qualities being furnished by the intelligence and brains of those who had charge of the wire mill. If I were to be asked who was the first in history of Bessemer steel development to utilize the crop ends of a steel rail so that it could be rolled and drawn into wire, I would reply, the wire mill of the Cleveland Rolling Mill Co. If I were asked who was the first to take Bessemer steel scrap in the shape of crop ends and short rail butts, box pile them, and roll the pile into billets first of all and afterwards into wire rods for the purpose of being drawn into wire, I would say, the Cleveland Rolling Mill Co. If I were asked who first made steel spring wire from Bessemer steel, and who at one time—and that up to a very recent date— made the best spring wire in this country, I would say the wire mill of the Cleveland Rolling Mill Co. If I were to be asked who, when harvest binding wire was in demand, had control of 80 per cent of the trade, owing to quality, I would say, the wire mill of the Cleveland Rolling Mill Co. If I were asked who furnished the first Bessemer steel in shape to be made successfully into wood screws, I would answer, the Cleveland Rolling Mill Co. If I were asked who were the first to override the traditions of the wire drawing industry, and to adopt certain lines of their own, I would reply the wire mill management of the Cleveland Rolling Mill Co. If I were asked who were the first to roll 4-inch billets successfully into wire rods, which created a new article of commerce, viz., a 4-inch steel billet, today as staple as pig iron, and which caused all the old established wire rod mills to remodel at a great expense in order to use this billet, I would say, the Cleveland Rolling Mill Co. And one of the strongest advocates of the improvement was Mr. W. J. Hayes. If I were to be asked to point out one of the most, if not the most, successful wire mills in the world, and which made the most money in a given time, according to the amount of money invested, I would without the least hesitancy answer, the wire mill of the Cleveland Rolling Mill Co. The position the Cleveland Rolling Mill Co.'s wire mill held in the wire trade, the diversity and quality of its product, and the volume of its business, compelled recognition from the leaders of the recent wire and wire rod combination. And it is very questionable if the Cleveland Rolling Mill Co. had been taken into the combine were it not for its wire mill.

"I remember the time when 10 tons of wire rods was a day's work for the wire mill of the Cleveland Rolling Mill Co. I remember the time when Mr. Hayes told me that if he lived to see the day when the wire mill would draw 100 tons in 24 hours he would be more than satisfied. And here today you are drawing over 300 tons per day, and drawing wire from as fine as your hair up to several inches in diameter for shafting. When Mr. Hayes first took charge of this wire mill, about 1870, 10 tons was the daily capacity, and it was, to the best of my knowledge, the only wire mill west of New Jersey. Since that time, the successful career of this mill has induced others to go into the wire business, so that today, in Cleveland alone, we have the American Wire Co., the HP. Nail Co., the Baackes Wire Nail Co., and other smaller wire concerns; and this city has a greater capacity for making wire rods and drawing them into wire than any other city in the world—a capacity of 1,200 tons per day. In the city of Cleveland alone, nearly 8,500 men are employed in the wire business. Multiply this by 5, and we have over 40,000 souls, or about 10 per cent of the population of Cleveland who are maintained and get a living from the manufacture of wire. And all this had a start about 30 years ago, from a small wire mill of 10 tons daily capacity."

INCREASE IN WEIGHT OF LOCOMOTIVES.

Heavier rails, heavier bridges, heavier locomotives and heavier cars, are the order in railroad construction, and the increase in tonnage to the iron trade, while the evolution is in progress, will be an item of great significance. At the Brooks Locomotive Works, Dunkirk, N. Y., the average weight of the locomotives built in 1899 was 270,412 lbs., as compared with 184,629 lbs. in 1891. These figures cover locomotive with tender. For the engine alone the increase was from 112,633 lbs. in 1891 to 165,768 lbs. in 1899, or an average gain in the engine alone of over 53,000 lbs. The *Engineering News* comments on the tendency:

"Figures have recently been given to us by two of the leading locomotive works of the United States showing the average weight of the locomotives turned out by them during the past year and during 1891. They show an increase in the weight of the average locomotive of about 50 per cent. That is to say, the average locomotive turned out last year weighed about 1½ times as much as the average locomotive turned out eight or nine years ago. Probably these figures somewhat exaggerate the progress made in that time toward heavier locomotives for standard freight and passenger service. The increased use of electric motors has nearly stopped the construction of small locomotives for suburban and other railways which was more or less of a feature at the beginning of the decade, and which served to reduce the average weight of the machines built. Yet making all allowance for this, it is plain that a great increase has taken place in the size of both passenger and freight locomotives. One firm which built 300 locomotives last year reports their average weight (locomotive and tender in working order) as 270,412 lbs. How great this increase is over the practice of a dozen years ago may be realized by reference to Wellington's 'Economic Theory of Railway Locomotion,' published in 1887. In that book was given (p. 410) a table of the four most powerful locomotives in the world. They were two mastodon locomotives (a Lehigh Valley with 155,000 lbs. total weight of both engine and tender and a Southern Pacific weighing 186,000 lbs.) and two decapods 'El Gubernador' of the Southern Pacific, weighing 239 650 lbs., and a Baldwin engine with a pony truck in front, weighing 224,000 lbs. Of 'El Gubernador,' Mr. Wellington said: 'This locomotive develops the enormous tractive power of 32,039 lbs., or just 39 lbs. more than one-fourth the weight of the drivers.' This was, indeed, enormous at that day, and

yet in less than a dozen years from the time that was written, locomotives were built with a tractive power of over 53,000 lbs. We shall not now attempt to discuss the causes which have led to this increase in locomotive dimensions, further than to remark that they may be summed up as an increase in the weights and speed of both passenger and freight trains, both of which have come about through the demand for greater economy in the movement of a traffic that has grown and multiplied year by year."

About 100 men employed in the various warehouses of the Republic Iron & Steel Co., at Youngstown, O., were given an advance of 10 cents a day or to $1.50 on Jan. 1.

Figures concerning the business of the Colorado Fuel & Iron Co., show that its business in iron steel and iron ore in 1899 amounted to $7,681,718 92, against $4,532,243.10 in 1898; including coal and coke, to $12,931,719, against $9,269 098 in 1898. The production of coal was 3,250,000 tons against 2,838,000 tons; of coke, 500,000 tons against 398,000 tons The production of pig iron was close to 100,000 tons; of spiegel, 4,230 tons; steel rails, 82,469 tons; plates, 1,532 tons; merchant iron, 32,508 tons; castings, 8,458 tons; iron pipe, 8,016 tons; nuts, bolts and spikes, 9,379 tons.

The Ohio Iron & Steel Co., Lowellville, O., increased its capital last week from $150,000 to $500,000, that it might represent more nearly the cost of the property with surplus. The company has made a number of improvements in the past few years and has others in contemplation.

At a meeting Jan. 1 of those interested in the reorganization plan of the Pottstown Iron Co., Pottstown, Pa., it was agreed to issue new stock to the second mortgage bondholders, and to the unsecured creditors respectively. First preferred stock to the amount of $750,000 will go to the second mortgage people, and second preferred stock to the unsecured creditors, whose claims also aggregate about $750,000. The next step will be the resignation of the old board of management and the election of a new one.

ECLIPSE PNEUMATIC TOOLS.

W. J. Schaefer & Co., 33 Barclay st., New York, make a specialty of pneumatic tools, notably the Eclipse pneumatic hammer, shown in Fig. 1, which has been in use for some time in boiler and bridge works for riveting, in foundries for chipping castings and in machine shops for a variety of work. The features to which the manufacturers call attention is the absorption of the vibration by a spring handle, saving the workman from the discomfort and often positive distress attending the use of some types of air hammers. The blow is regulated by pressure on the handle, so that the operator is relieved from any attention to the regulation of the air admitted, the admission valve being operated automatically. It is claimed, further, that repairs can be easily made, the construction being not intricate, and the attention of the factory being not required in case of a break. The hammer is intended for general boiler and machine work and for marble and stone cutting. A pressure of air ranging from 20 to 100 pounds is employed, 80 pounds being generally most desirable for metal work. Tools used in the hammer are made with shank 1¾-inch in length and turned to fit the end of the hammer snugly, the striking face of the tool being at right angles with its axis. When it is necessary to take the hammer apart the screw plug is removed from the outer end of the throttle case and the spring and valve removed; then with a wrench the valve chamber is unscrewed from the body of the hammer and the handle raised from the body. A bar of metal is placed in the tool socket long enough to force the piston up against the inner valve casing, and with light blows the casing is forced out and access obtained to the valve. Three sizes are manufactured, for boiler makers' work, light chipping in foundry and machine shop, and heavy chipping, respectively.

FIG. 1.—ECLIPSE PNEUMATIC HAMMER.

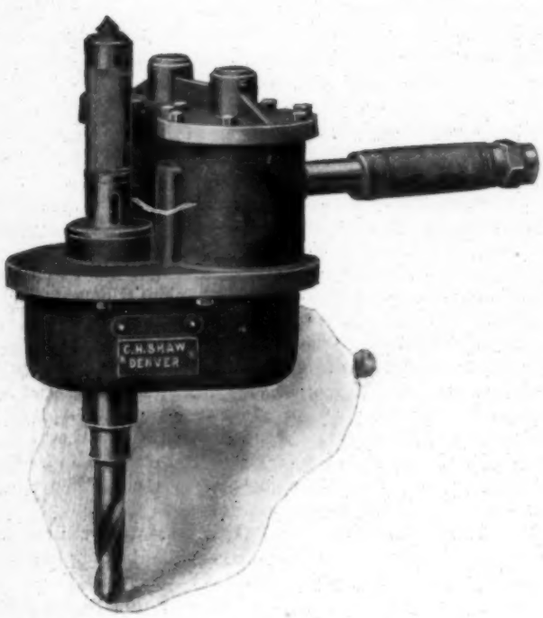


FIG. 3.—SHAW TWO-CYLINDER PNEUMATIC DRILL.

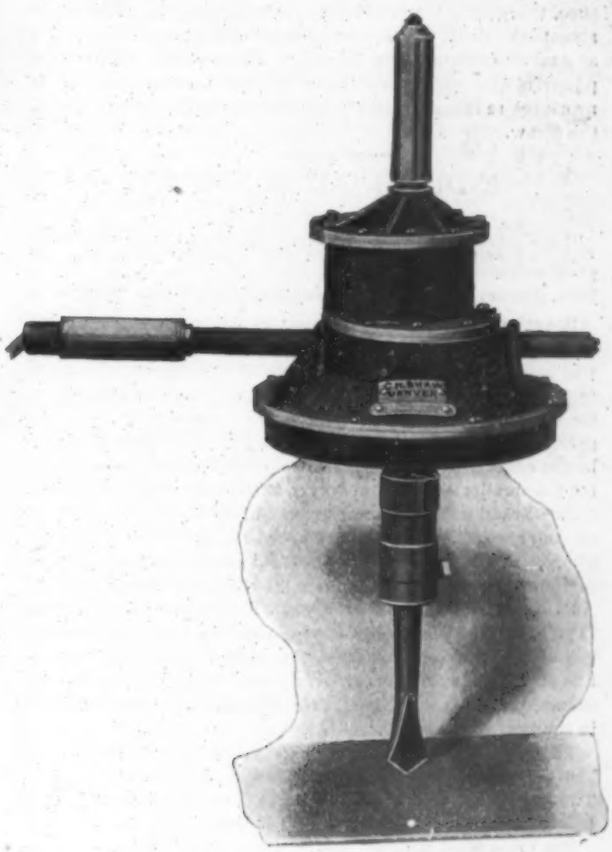
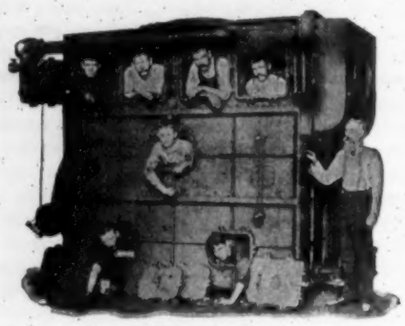


FIG. 2.—SHAW COMPOUND ROTARY DRILL.

Illustrations are given also of the Shaw pneumatic rotary drills, put on the market by W. J. Schaefer & Co., who in addition furnish Ingersoll-Sergeant steam-driven air compressors for the driving of various pneumatic tools they supply. Fig. 2 shows a compound rotary drill, having one high-pressure and one low-pressure cylinder, thus using the air twice and exhausting a little above atmospheric pressure.



A "Cochrane."

COCHRANE HEATERS.

The effect on a plant of a good feed-water heater that will deliver water close to 212° can be quickly figured in this way: For every 10° that the temperature of the water being delivered to the boilers is under 212° over, 1% of the total fuel bill can be saved, if there is exhaust steam available to do this heating:

For Example,

If your present feed-water heater is only delivering water to boilers at a temperature of 150°, with plenty of exhaust steam—then this heater is not coming within 6% of what a good heater will do for you, either in increased quantity of eam or smaller coal bills.

Manufacturers of the COCHRANE STEAM SEPARATORS.

HARRISON SAFETY BOILER WORKS,
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PHILADELPHIA, PA.

Best results are obtained with this tool at 100 pounds pressure, this giving better efficiency from expansion. Fig. 3 represents the C. H. Shaw two-cylinder pneumatic rotary drill at quarter centers, there being no dead center. This is a powerful drill capable of being used in narrow places. It measures 12 inches from the end of the chuck to the end of the screw.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

Specifications are being sent out by the waterworks department of Cleveland for three pumping engines. The contracts will call for the completion of the first of the engines in 12 months. Two years or more are given for the building of the other two. One pump is to have a capacity of 20,000,000 gallons a day, and the others each 25,000,000 gallons. The larger engines must be of the crank and flywheel pattern, but for the smaller engine the compensating type will be accepted.

The Braddock, Pa., council opened bids for new boilers at its water works, Jan. 5. The figures ranged from $4,000 to $8,000. A new pump and injector, to cost $16,000, and a new pumping house were authorized, at a total cost of $35,000.

R. A. McCarthy, architect, 1518 Deloss st., Indianapolis, Ind., is making plans for a bridge and machine shop, 42x54, two stories, and desires catalogues on 20 h. p. gas and gasoline engine, power hammer, air riveter, air and chain hoists, shears, punch, saw, planers, drills, lathes, etc., to be installed in the next 60 or 90 days.

The Acme Foundry Co., of Cleveland, capital stock $30,000, has been incorporated to manufacture gray iron castings. The incorporators are L. G. Kranz, C. K. Sunshine, William Jassland, William Greenbaum and B. A. Spanye.

The Ohio Steel Roofing & Mfg. Co., of Belle Center, Logan County, O., has been incorporated by James B. Pergin, J. L. Pergin, J. E. Ramsey, Earl W. Ramsey and M. C. Laughlin. Capital $100,000. The company is to engage in manufacturing and dealing in steel roofing, spouting and galvanized tanks, sheet metals, etc.

The Salem (N. C.) Iron Works has been incorporated to manufacture all kinds of machinery, by A. Hege, Walter T. Spough, and Walter J. Hege; capital stock, $50,000.

The Maywood Foundry & Machine Co., Maywood, Ill., has been incorporated; capital stock, $50,000. Incorporators are F. M. Lonas, I. L. McCord and O. H. Davidson.

New Construction:—

The Snyder & Baker Foundry Co., Belleville, Ill., is planning an addition to its plant.

The George M. Newhall Engineering Co., Philadelphia, has made plans for two spike mills to be erected for Davis Bros., Philadelphia. The structures will be 77x153 feet, and 77x181 feet.

At Alexandria, Ind., the Cellular Insulating Co. will rebuild its plant recently destroyed by fire. It will be one story, 150x125 feet. The equipment will include engine, boiler, drill press, shafting, pulleys, belting, etc.

The Cotton Belt Railroad is erecting a brick machine shop, 100x160 feet, at Tyler, Tex.

The Schuh & Martin Foundry Co. is erecting new buildings in Covington, Ky., on the site of the buildings destroyed by fire four weeks ago. The new foundry will be in operation by Feb. 1.

The B. E. Wallingham Plow Co.'s plant at Macon, Ga., purchased by E. G. Coffman, of Atlanta, Ga., will be enlarged.

The trustees of Tonawanda, N. Y., have passed a resolution exempting from all local taxation for 20 years the Inland Steel Co., which is to build a rolling mill plant there. The conditions are that the plant be finished within a year and always employ at least 150 men.

The Stewart Wire Co., Easton, Pa., sold last week two tracts of land in South Easton to Thomas A. H. Hay for $25,000. The principals represented by Mr. Hay are not known.

Meadville, Pa., is working for the location of a malleable iron plant, the Chamber of Commerce having $50,000 pledged and requiring $25,000 more.

The Republic Iron & Steel Co. will erect a new shafting department at the Mahoning Valley plant, Youngstown, to be ready for operation in April.

The Monongahela River Consolidated Coal & Coke Co. will erect three electric power houses at different points along the Monongahela river to furnish power for the operation of its mining machinery. The plants are to go up at Gastonville, Brownsville, and Monongahela. The stations will cost about $150 000. Orders have been placed for 35 electric and seven compressed air mining machines to be used in the mines nearest the proposed power houses.

The Riter-Conley Mfg. Co., Pittsburg, has the contract for the erection of a new forge building for the Reading Iron Co., Reading, Pa. It will be 500x100 feet.

The Birmingham Railway & Electric Co., Birmingham, Ala., has awarded the contract for rebuilding its car shops, recently burned.

At Norfolk, Va., bids were opened Jan. 6 for the construction of a building for electric plant, plumbers' shop and machine shop, of steel and brick, about 110x180 feet, at the navy yard.

The Carolina & Northwestern Railroad Co., L. T. Nichols, general manager, is erecting roundhouse and machine shops at Chester, S. C.

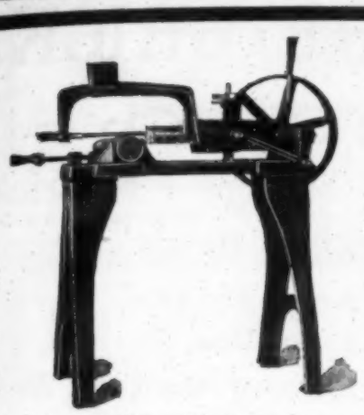
The Anniston (Ala.) Locomotive & Machine Works will rebuild its foundry recently burned. The new building will be larger and better equipped.

The Birmingham (Ala.) Machine & Foundry Co. is pushing work on its new foundry building, which will 100x250 feet, fire-proof, and well equipped with electric cranes.

Fires and Accidents:—

A fly-wheel burst at rod mill No. 3, of the American Steel & Wire Co.'s Cleveland Rolling Mill plant, Jan. 5. Operations will be interrupted for some time.

At Altoona, Pa., the Juniata blacksmith shop of the Penn-



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sylvania Railroad burned Jan. 5. It was 225x75 feet, employing 250 men, and contained five large size steam hammers, with oil furnaces, etc. Loss, $80,000.

The Pittsburg District :—

A charter has been issued to the American Metal Welding Co., Pittsburg, with $10,000 capital stock. The company controls certain patents for welding metals, and may erect a plant in the Pittsburg district. The incorporators, who are mostly Pittsburg daily newspaper men, are W. A. Magee, John M. Anderson, Crombie Allen, Morgan E. Gable and C. H. Reymer.

The Star plant, Pittsburg, of the American Tin Plate Co., will be put in operation Monday, Jan. 15, after an idleness of several weeks.

The usual bi-monthly examination of shipments and prices of bar iron is being made at Youngstown this week to fix the January and February wages of puddlers and finishers.

The Jas. H. Baker Mfg. Co., Pittsburg, will shortly add a night turn at its works at Tarentum, Pa., making wagon hardware.

Jones & Laughlins, Ltd., have nearly completed their additional soaking pits in the Bessemer department. They will be put on in about a month, and will increase the steel capacity by from 300 to 400 tons a day. In a short time they will probably replace their converters with larger vessels, by which a further increase in capacity will be made. The new structural mill begun some time ago is now well under way. Work on the foundations is to be started at once so as to be ready for the machinery when completed. The mill will be erected in a different location from the present structural mill, and a small part of the machinery of this mill will be used. The new mill will be equipped in the most complete manner.

The Carnegie Steel Co , Ltd., is pushing work on one of the two new Carrie furnaces at Rankin, having 500 men employed, divided into day and night shifts. The effort is being made to complete it by the time old furnace No. 1 is put out for relining and other repairs.

P. Rieseck's structural and ornamental iron works in Allegheny burned last week with $10,000 loss. The fire started from the bursting of a gas pipe in the engine room.

The Otto Gas Engine Co., through its Pittsburg office, has contracted to install for the Oliver Iron & Steel Co., of Pittsburg, a 100 h. p. and a 60 h. p. Otto engine, new type; also one 60 h. p. Otto gas engine, special electric type, for Zug & Co. The latter concern installed a 35 h. p. Otto gas engine in their new galvanizing plant at Sixty-first st., Pittsburg.

Furnace B of the Edgar Thomson group has been put on ferro-manganese.

Moorhead Bros. & Co., Sharpsburg, Pa., will have eight additional puddling furnaces in operation in about three weeks.

General Industrial Notes:—

The first plates were rolled last week at the plant of the Tidewater Steel Co., Chester, Pa.

The rod mills of the two plants of the American Steel & Wire Co., Braddock, Pa., resumed operations last week.

The W. J. Clark Co., Salem, O., is putting another plate bending and forming machine into its works, having bending power equal to 156,000 pounds.

It is stated that the coking coal lands in Pennsylvania, reported purchased by the National Steel Co., embrace 7,000 acres, instead of 3,00 acres.

The Sharon Steel Co., Sharon, Pa., will increase its capital stock from $3,000,000 to $4,000,000.

It has been stated officially that the executive committee of the American Tin Plate Co. has requested William H. and J. H. Moore to obtain proxies for the annual meeting, to be held Jan. 16. The members of the board of directors whose

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MALLEABLE

HIGH GRADE CASTINGS. QUICK DELIVERIES.

BUHL MALLEABLE CO., Detroit, Mich.

term expires will probably be re-elected. The reports concerning a proposed change in president are understood to be entirely without foundation.

The West Duluth Malleable Iron Works are fully employed, having a force of 130 men, which it is desired to increase.

The Coshocton Rolling Mill Co., Coshocton, O., is completing two sheet mills and will add a third. Common and cold rolled sheets will be manufactured and a specialty will be made of Beard's "royal blue" steel. Ambrose Beard is president, W. C. Bryant, secretary, D. A. Raiff, treasurer, and Wm. E. Ward, superintendent.

The Central Steel Co. has started in a preliminary way a part of the old Premier plant at Indianapolis, idle since 1893.

The Oliver Iron Mining Co. has purchased another machine manufactured by the Keystone Driller Co., of Beaver Falls, Pa., for locating and proving up iron ore deposits on Minnesota lands.

The Wheeling, W. Va., chamber of commerce is trying to secure the extensions of the Riverside plant which Manager Hearne, of the National Steel Co., has decided will not be made because of the exorbitant prices asked for land adjoining the company's property. An effort is being made to raise among business men the difference between the company's offer and the amounts demanded by owners.

The controlling interest in the Bessemer Rolling Mill Co., Bessemer, Ala., has been sold by Morris Adler & Co., presumably to the Republic Iron & Steel Co. Repair work has been going on for some time, preparatory to starting the plant.

Exceedingly favorable accounts of the earnings of the industrial companies engaged in the steel industry continue to find their way into Wall Street and receive due attention, there being no reason to doubt their substantial accuracy. As yet, however, the figures bearing upon the performance of these companies during the past year have not been made public, which to a certain extent may explain the apparent reluctance of the market to make such accounts of the prosperity and probable dividend payments to the shareholders of these concerns the basis for a speculative or investment

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movement of their stocks. It would seem, however, that interests connected with the various concerns in question, notwithstanding the hanging back of the stock market at large, have such a confidence in the future of steel and iron corporations that they have during the past week given decided, and in some cases effective, support to their various specialties. The fact that the discrimination of lenders of money against industrials is not as marked as it was a short time ago has also contributed toward the decided rally which has been seen in iron and steel stocks, and to a certain extent in other portions of the industrial department of the general market.—[Bradstreet's.

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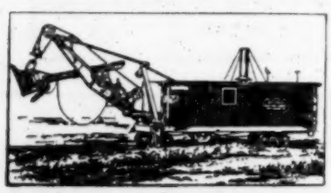

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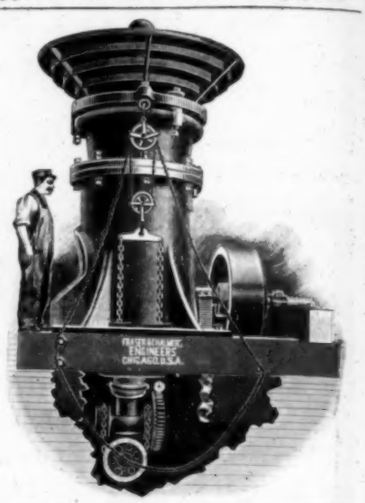

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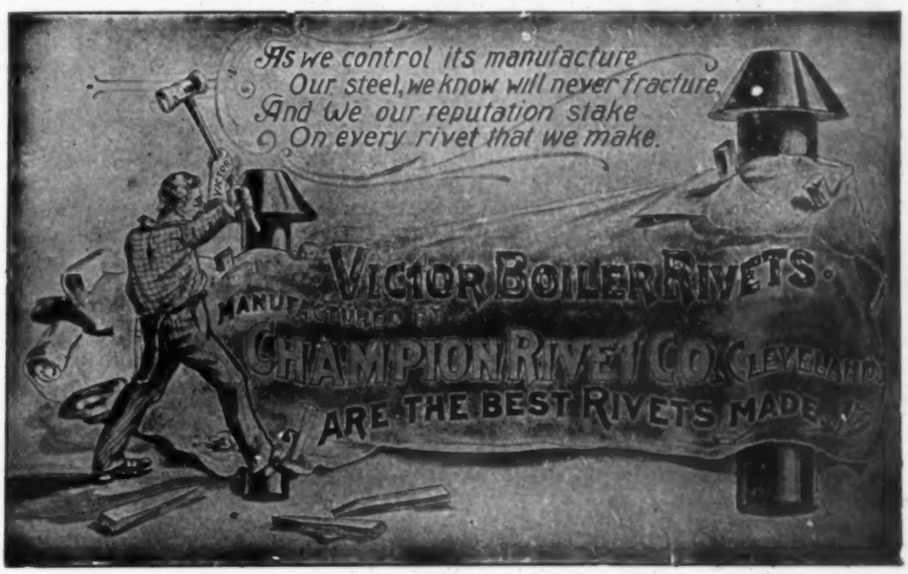
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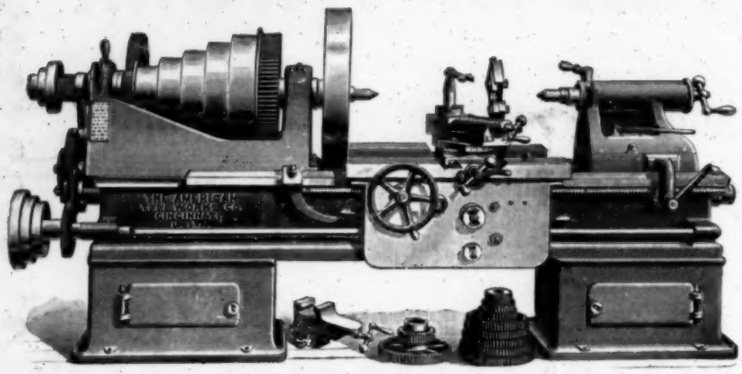

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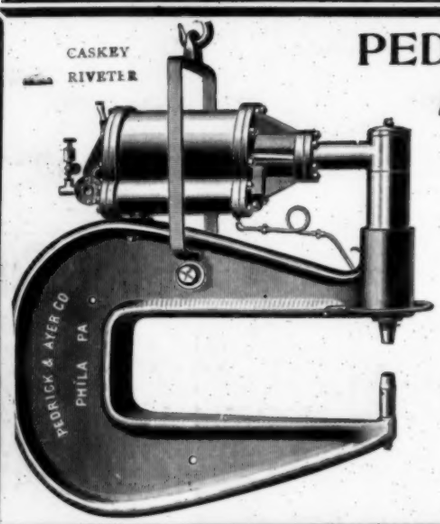

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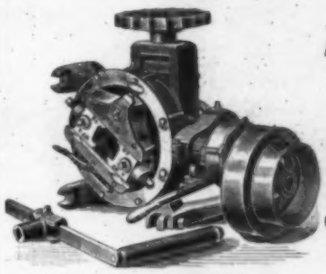

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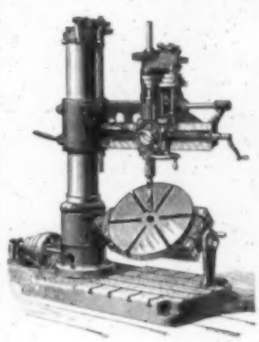

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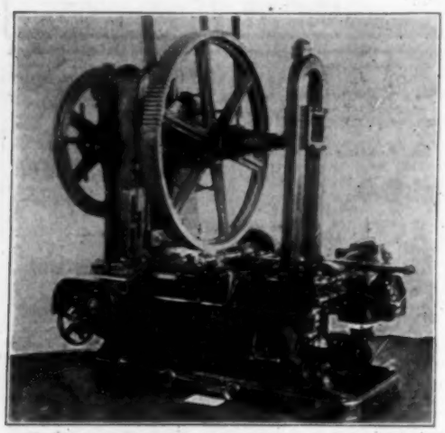

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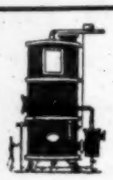

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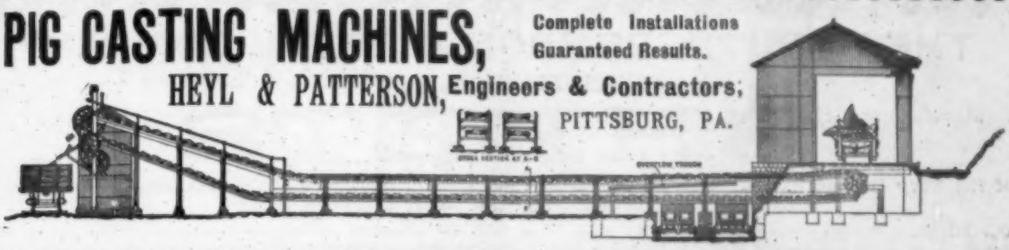

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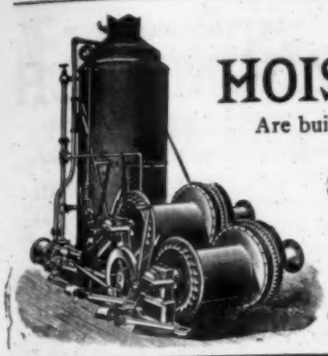

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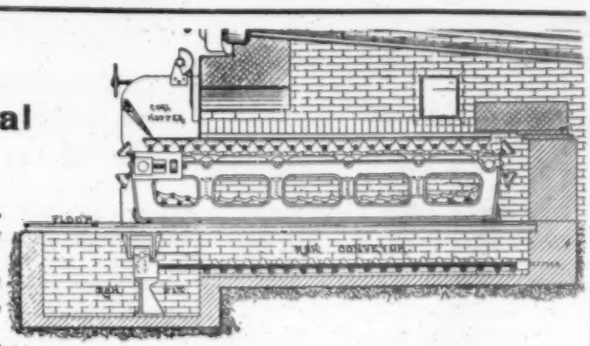

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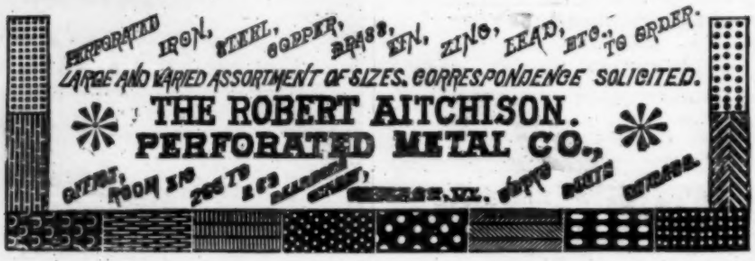
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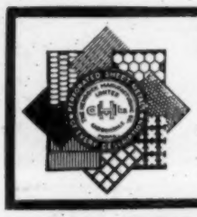

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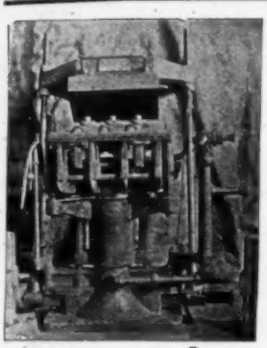

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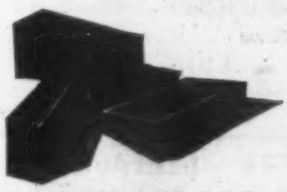

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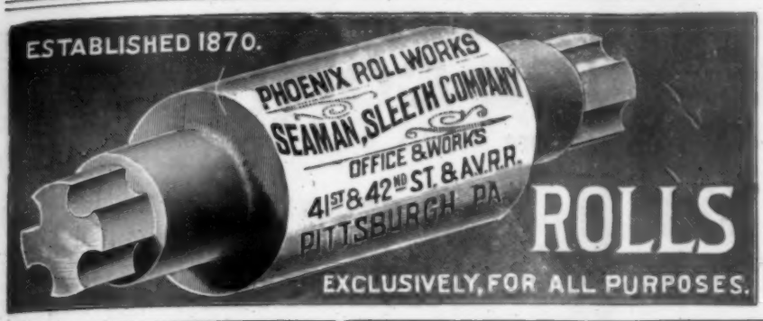

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The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

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4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:40	2:30	6:44	Elyria	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6:58
5:15	3:12	7:23	Lester	8:25	10:50	6:40
5	3	1	Main Line	2	4	6
5:30	3:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:26	8:22	Lester	7:29	10:49	6:19
6:52	3:35	8:30	Medina	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling	6:48	10:12	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover.	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport	.....	6:05	1:40
.....	8:25	.....	Bellaire	.....	5:50	.....
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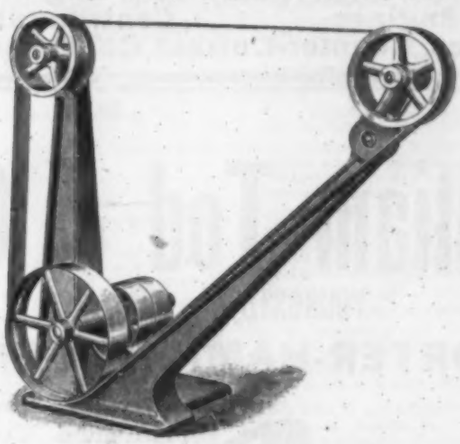

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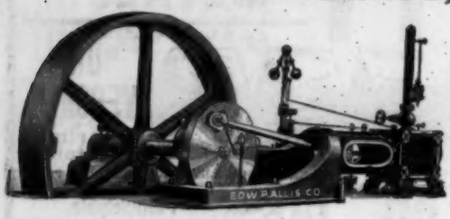

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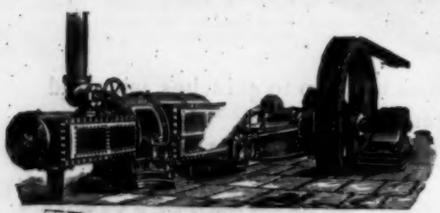

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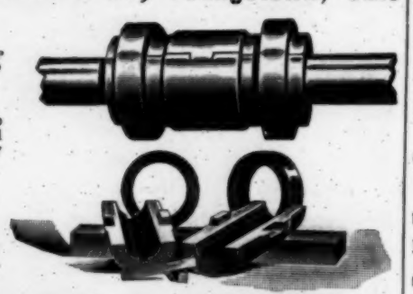

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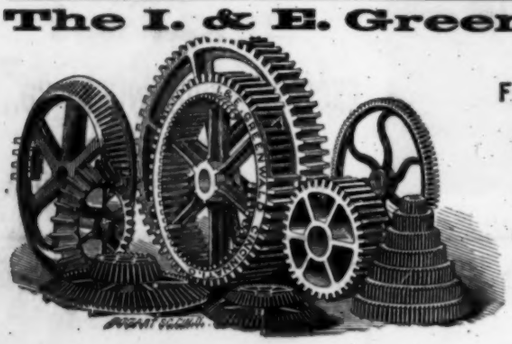

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Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.

CRANES—
Northern Engineering Works, Detroit, Mich.
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Crane & Car Co., Cleveland, O.

CRANK HANDLES—
Norwood Bicycle Co., Cincinnati, O.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.

CUTTER AND REAMING GRINDERS—
American Tool Works Co., Cincinnati, O.

DIES—
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield, Mass.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O
Buhl Malleable Co., Detroit, Mich.
Excelsior Iron Works Co., Cleveland, O.

EMERY AND CORUNDUM WHEELS—
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas Taylor's Sons Co. Cincinnati, O.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLEXIBLE SHAFTS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas H. Baker Mfg. Co., Pittsburg, Pa.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Excelsior Iron Works Co., Cleveland, O.
Macbeth & Co., Cleveland, O.
Vulcan Foundry & Machine Co., New Castle, Pa.

FOUNDRY EQUIPMENT.
Tabor Mfg. Co., Elizabeth, N. J.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton

Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

FURNACES—
Playford Stoker Co., Cleveland, O.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
W. S. Rockwell & Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.

HANDLES—
Norwood Bicycle Co., Cincinnati, O.

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

HOISTING MACHINERY—
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Universal Construction Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
E. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Ogilebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANUFACTURING CHEMISTS—
We Fu Go Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILL CASTINGS—
Vulcan Foundry & Machine Co., New Castle, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
American Tool Works Co., Cincinnati, O.

ORE CARS—
The Pressed Steel Co., Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Rogers, Brown & Co., Cincinnati, O.
Reed P. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.

PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Universal Construction Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.

PNEUMATIC TOOLS—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago, Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

RELAYING RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
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DIRECTORY

To the Iron and Steel Works of the United States for 1898.

PUBLISHED BY
THE AMERICAN IRON AND STEEL ASSOCIATION.

Thoroughly Revised. Price, Seven Dollars.

The American Iron and Steel Association has just completed a thorough revision of its Directory to the Iron and Steel Works of the United States, bringing down to April, 1898, a description of these works. It also contains a complete Directory to many leading industries which are large consumers of iron and steel. This edition, which is the fourteenth that has been issued, embraces more complete details of all the iron and steel works of the United States, and of industries which are large consumers of iron and steel, than any preceding edition. It retains all the old features of preceding editions and contains many new features.

In the edition for 1896 there was given for the first time a complete list of Malleable Iron Works in the United States, and to this new feature there are now added complete lists of the Rail Mills, Structural Mills, Steel Casting Works, Bolt, Nut and Rivet Works, Chain Works, Seamless Tube Works, and Riveted Pipe Works—all new features.

The lists of Plate and Sheet Mills and of Tin Plate and Stamping Works are much more complete than in previous editions. The names and location of all the works described are given in alphabetical order, followed by a description of their character, capacity and products, with the names of the principal officers, etc., including the names of selling agents. This edition makes a cloth-bound book of nearly 400 well-printed pages—many more than in any previous edition. It contains a complete list of all the

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Bessemer Steel Works,
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Wire Rod and Wire Mills,
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Iron and Steel Ship Builders,
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Wrought Iron, Wrought Steel and Riveted Pipe Works,
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Car Builders in the United States.

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This edition of the Directory is an invaluable book of reference for all business men who wish to correspond with iron and steel manufacturers or with iron and steel consumers, forming, in every respect, a COMPLETE GUIDE to the iron and steel works of this country and to the principal works which consume iron and steel.

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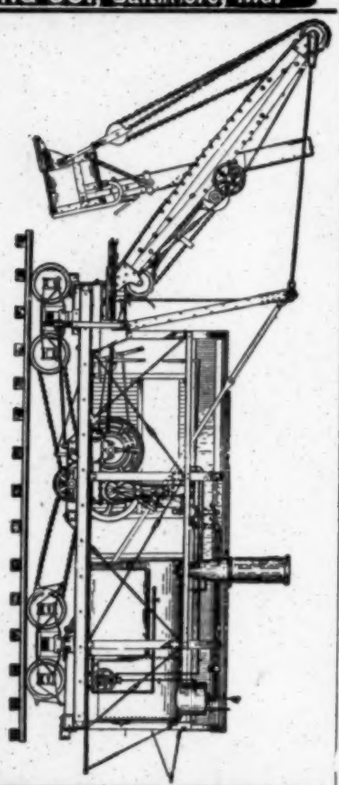

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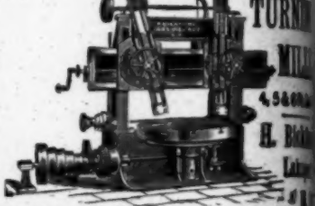

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